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A black and white photograph of a mechanical device, likely a pump or engine component. It features a large, rectangular block with a central opening, possibly a cylinder or a valve. To the right of the block, there are various pipes, valves, and a small, complex assembly of components, including what looks like a pressure gauge or a control valve. The entire device is mounted on a base, and the background is a plain, light-colored wall.

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ENCOURAGEMENT OF SCIENTISTS*

IT appears that there is a wide disparity between the emoluments of scientists in the Universities and those in administrative positions, mostly in Government or semi-Government Departments. Our first demand must, therefore, be for a uniform Scientific Service, with defined grades of status and pay, which have enough flexibility to permit unusual promotions by merit, and in which the salary differences between grades recognise service and ability without causing resentment and difficulty in the junior grades.

Although a comprehensive and integrated Scientific Service would, by virtue of the social understanding which produced it, recognise the directions in which scientists should be encouraged to improve their quality and extend their usefulness, nevertheless recognition will not be transformed into consistent action unless scientists themselves participate fully, and in an organised manner, in the transformation. It may be useful at this stage to consider the main directions in which scientists deserve encouragements that will benefit science and public welfare generally.

One obvious group of these directions would come under the heading of "Facilities". We need well-built, well-equipped, gracious places of work, which is no more than all workers need, except that some of our places of work should be very specifically planned for the work that is to be done in them. We need more libraries and the expansion of existing libraries, together with convenient access to general libraries that will help us to keep abreast with the advance of knowledge outside our fields. We also need, I believe, to build up personal libraries and to subscribe, in larger numbers than we do now, to periodicals important to our work and thought—which, in turn, means joining more societies than we do now.

This last point is extremely important, and you will have noted that its importance was stressed by Sir Asutosh Mookerjee at our first meeting. Indeed, intellectual stimuli through reading and personal contacts are so important that there is no doubt that, when our economic position improves, we shall relax more in the good company of books and fellow-workers at home and abroad, within our own fields and far outside them.

But for juniors, difficulties will remain even under improved economic conditions. I

* Excerpts from the Presidential Address of Dr. S. L. Hora to the Indian Science Congress, 1954.

accordingly suggest that funds should be established for making "book grants", that all our learned societies should allow "student members" or "associate members" at greatly reduced rates, and that these societies, helped by far-seeing philanthropists, and together with the Central and State Governments, should sponsor tours by juniors and students to various parts of India and abroad, sometimes to conferences but often for study and experience alone.

So much for facilities. There remains the associated question of "Rewards". The career of a junior in science (and, of course, in any branch of learning) must be secured as soon as he shows aptitude and positive intentions. He must be able to see in the Scientific Service, or in other opportunities for scientific employment, the fulfilment of his efforts and dreams.

But this is not enough. Before he begins his regular work he must be able to pursue and conclude some research of his own design at some centre of his own choosing, for a period which may vary from 1-3 years, according to his own purpose and performance. We know the usual way of providing such encouragements is to grant scholarships and fellowships through various agencies, and there is scarcely any need for me to say that they should be greatly increased in scope and quantity.

I come now to workers at the other end of their careers. All my correspondents are agreed that an incalculable wastage of scientific experience is going on in India through the neglect of retired scientists; and that this wastage not only applies to the work they themselves could be producing, but also to wastage in the efforts and directions of the young men and women who were working under their guidance.

RESPONSIVENESS OF NERVE CELLS

THE means by which the human brain is modified by its own past activity were discussed by Dr. E. D. Adrian, O.M., President of the Royal Society, in his address at the anniversary meeting of the Society held at Burlington House recently.

There were already some indications, Dr. Adrian stated, of the kind of alteration which may be produced in a nerve cell by repeated activity. Repeated stimulation of the nerve cells of the brain produced an increased responsiveness which could last for a minute or so, and Professor J. C. Eccles of the Australian National University, Canberra, and his colleagues had shown lately that even in the spinal cord, whose function was purely executive, a long period of inactivity led to a loss

Of these, some, no doubt, can still afford to continue their enquiries without payment; but they are not necessarily allowed to do so. There are gravely disturbing cases of gifted scientists, with records that would have brought them the highest honours elsewhere being refused "sitting accommodation" in the institutions they served for more than three decades. Their number is, however, far exceeded by the men who wish to continue their work; but cannot do so for financial reasons. They have to find other employment, sometimes in executive positions, sometimes in subordinate ones. In this connection, it is necessary to remember, as Dr. J. N. Ray has pointed out to me that "the expectation of life in India has now been increased by at least ten years".

There remains the question of rewards for those who are neither at the beginning nor near the end of their careers. Their rewards would lie largely in the satisfactions of work and social duty, and in the recognition which comes to them. Apart from Departmental and official recognition, and tokens of appreciation from international sources, there are the recognitions expressed by one's colleagues through selection to the honours of learned societies. I do want to say, however, that, to the best of my knowledge, no society anywhere has solved the question of "fairness" to the satisfaction of all its members, since "fairness" is apt to be individually defined. At the same time, the position continuously improves in every reputable society everywhere, in response to progress in the sense of responsibility of its Fellows, in whom a high regard for a flexible and democratic election procedure, with provision for complaints and appeals, thereby becomes increasingly evident.

of responsiveness which was restored by a short period of enforced activity and tended to persist for a matter of hours.

For the study of physical changes which accompany these alterations there was available an extension of a method, again introduced by Professor Eccles, by which the interior of a nerve cell could be examined by the use of a micro-electrode. It was naturally more difficult to study the biochemistry of the individual nerve cell, but the storage process might well involve a chemical as well as a physical reorganisation. If the cell chemistry of a grown man could bear the mark of an infection with measles in childhood, it was not unreasonable to suppose that the nerve cell constituents were plastic enough to be modified by past activity.

RICE DIETS AND FERTILITY RATE

S. RANGANATHAN

Nutrition Research Laboratories, I.C.M.R., Coonoor, S. India

THE concentration of a major portion of the world's population in the rice belts of the world has given rise to speculations about a possible correlation between consumption of rice diets and increased human fertility rate. While this association was never scientifically and critically examined, it was allowed to gain ground in lay circles. An additional impetus was given to it by utterances emanating from Japanese sources and reported in the lay Press in India about a year ago; since then, the existence of this association was taken for granted and repeated often. Mention was made in the Press recently about the Government of India seriously thinking of starting investigations to find out the existence or otherwise of an association between rice consumption and fertility. It is but meet that the existing data on the subject, collected at great pains and expense by Governmental agencies, should be pooled and critically assessed, before fresh investigations are undertaken. If the results of such an enquiry should prove inconclusive, the need for fresh investigation would obviously arise. An attempt has, therefore, been made to assess the existing data in India and elsewhere from this particular angle.

Fortunately, figures of birth-rate are available, 'State-wise' ('Province-wise' before the partition of India in 1947), published annually by the Director-General of Health Services, Government of India. It is also fortunate that the Provinces of India, now called the States, fall into certain fairly well-defined divisions so far as the staple article of the diet of the population is concerned. Thus, it is possible to differentiate broadly the rice-eating States from those where the staple article of food is something other than rice, say wheat or millets. Assam, Bengal (after 1947, West Bengal) and Madras are the three principal rice-eating areas of India, while the Punjab, United Provinces and Ajmere-Merwara are predominantly wheat-eating areas. The birth-rates per mille for 12 States of India for the four years, 1946 to 1949—figures for 1949 are the latest available—and the average birth-rate for the entire Indian Union for the same period are given in Table I (*Statistical Appendices to Annual Report of the Director-General of Health Services*² for the years 1948 and 1949, Part I).

It will be seen from Table I that the lowest birth-rates in India are to be found in Coorg

TABLE I
Birth-rate per mille

	1946	1947	1948	1949
Ajmere-Merwara	.. 33.4	33.9	25.7	26.6
Assam	.. 18.9	15.6	15.3	15.1
Bihar	.. 23.0	18.6	18.0	17.7
Bombay	.. 33.8	33.6	32.5	33.5
Coorg	.. 18.8	17.8	15.1	17.6
Delhi	.. 35.5	29.8	25.6	31.2
Madhya Pradesh	.. 37.2	34.9	33.2	35.5
Madras	.. 32.1	33.2	30.8	30.9
Orissa	.. 28.5	27.8	27.2	26.6
Punjab (I)	.. 38.3	32.8	35.0	38.4
Uttar Pradesh	.. 25.3	23.3	20.6	22.3
West Bengal	.. 23.8	19.2	20.4	21.1
Indian Union	.. 29.2	26.6	25.2	26.4

and Assam, both of them being principally rice-eating areas. The figures range from about 15-18 per mille and are well below the average of about 25-29 for the Indian Union. This consistently low figure should give the quietus to the theory that rice diets conduce to increased fertility. Additional data showing lack of correlation between rice consumption and fertility are again available from the same table. The birth-rate for the Punjab, an almost exclusively wheat-eating area, is the highest in India and amounts to 38.4 per mille (1949); rice enters but little into the diet in the Punjab. Again, the birth-rates in the States of Bombay, Madhya Pradesh and Delhi are equally high, all being well over 30 per mille; the staple articles of diet in these regions are millets and wheat. The birth-rate in the Madras State, a predominantly rice-eating area, is no doubt high, being in the neighbourhood of 30 but the fact that it is nearabout the same or lower than the figures obtaining in areas where rice hardly enters into the diet of the people should provide unequivocal evidence of the lack of any association between rice diets and fertility rate.

Quite apart from the data published by the Director-General, Health Services, Government of India, an examination of the figures given by other demographers point to the same conclusion. Table II gives data of birth-rates for ten Provinces together with figures for all-India for the three decennial periods ending with 1931

(Gyan Chand³). The same figures have also been quoted by Blunt¹ and by Radhakamal Mukerjee.⁴ Unfortunately, the sources from which these figures have been obtained are not mentioned. However, they should prove useful in so far as a comparison could be instituted within the table itself.

TABLE II
Birth-rate per mille

	1901-11	1911-21	1921-31
Assam	.. 35.7	32.3	30.3
Bengal	.. 37.6	32.8	28.5
Bihar and Orissa	.. 41.0	38.8	36.3
Bombay	.. 33.4	34.2	35.9
Madhya Pradesh	.. 49.6	45.5	43.7
Madras	.. 30.8	30.7	34.6
Mysore	.. 17.1	19.0	18.9
N.-W. Frontier Province	34.6	32.8	28.0
Uttar Pradesh	.. 41.4	42.2	35.1
Punjab	.. 41.2	43.8	42.2
All-India	.. 38.0	37.0	35.0

The figures in the above table afford incontrovertible evidence for the same lack of association between rice consumption and birth-rate. Madhya Pradesh, Punjab and Uttar Pradesh have a higher birth-rate than the Provinces of Madras and Bengal, principal rice-eating areas of India.

Again, figures for population increase during the last three decades shown in Table III reveal the same story (B. Viswanath⁵).

TABLE III
Showing percentage of population increase

	1921-31	1931-41	1941-51
Indian Union	.. 14.3	13.4	13.4
Travancore-Cochin	.. 26.3	18.9	23.6
Madras	.. 10.0	11.6	14.3
Uttar Pradesh	.. 6.7	13.6	11.9
Bihar	.. 11.6	12.3	12.3
Madhya Pradesh	.. 13.7	10.3	8.6
Punjab	.. 9.9	17.9	?

Travancore-Cochin State shows the highest increase. This State is highly deficit in rice, and produces and consumes tapioca and sweet potato in large quantities. This fact, again, does not appear to square with the idea of rice diet promoting fertility. The population increases in Uttar Pradesh, Bihar and Madras are

very nearly alike and yet, only in the State of Madras, rice forms the principal article of diet of the majority of the population, though in certain parts of Bihar and Eastern U.P., rice may form the staple. Further, there was a greater increase in population in Madras during 1941-51, when some wheat replaced rice on account of the shortage of the latter, than in the corresponding periods of 1931-41 and 1921-31 when practically nothing but rice constituted the staple food for the bulk of the population.

Having studied the figures available for the various States in India, a comparison may now be instituted between the birth-rates in the rice-consuming countries of the world and the corresponding figures for the non-rice-eating areas. Comparative data for ten countries are given in Table IV (Gyan Chand,³ loc. cit.).

TABLE IV
Birth-rate per mille

	1881-91	1921-25	1926-30	1931-35
United Kingdom	.. 32.5	20.4	17.2	15.5
Sweden	.. 39.1	19.1	15.9	14.1
Norway	.. 31.0	22.2	18.0	15.3
Germany	.. 36.8	22.1	18.4	15.9
France	.. 23.9	19.3	18.2	16.5
Spain	.. 36.2	29.8	28.5	26.9
Japan	.. 27.2	34.6	33.5	31.6
Rumania	.. 41.4	37.9	35.2	32.8
India	.. 35.9	32.7	33.3	34.3
Italy	.. 37.7	29.7	26.8	23.8

The figures in the above table do not show any specific correlation between rice consumption and fertility. On the other hand, they show a general fall in the birth-rate in the Western countries during the last about 40 years, with no major change taking place in dietary habits in so far as the staple article is concerned; presumably due to social conditions and artificial measures adopted to restrict births. The birth-rate in India has remained more or less steady during this period while in Japan, there has been an increase from 1881-91 levels. The chief cause for this rise is to be sought elsewhere than in the diet. The severe laws passed against abortion and infanticide, motivated probably by political considerations, has helped to raise the birth-rate from about 25 in 1872 to 34.6 in 1921-25, a rise unique in the history of population growth. Japan has been subsisting on rice for aeons of time. Yet, her birth-rate was only 27.2 during 1881-91,

being the lowest among the ten countries for which figures have been given in Table IV, the only exception being France. Again, figures for the trend of birth-rates compiled by Whelpton and Kiser⁶ for the various countries of the world show that Central and South America have a higher birth-rate than India and Japan.

Thus, it should be clear that the existing data in India and elsewhere do not reveal any association between consumption of rice diets and increased human fertility.

1. Blunt, Sir Edward, *Social Service in India*, 1938, His Majesty's Stationery Office, London.

2. Director-General of Health Services, *Statistical Appendices to Annual Report for the years 1948 and 1949*, 1953, Manager of Publications, Delhi.
3. Gyan Chand, *India's Teeming Millions*, 1939, George Allen & Unwin Ltd., London.
4. Mukherjee, Radhakamal, *Food Planning for Four Hundred Millions*, 1938, McMillan & Co., London.
5. Viswanath, B., *Symposium, Central Food Technological Research Institute, Mysore*, 1952.
6. Whelpton, P. K. and Kiser, C. V., *Annals of the American Academy of Political and Social Science*, 1945, 237, 112.

DR. HEM SINGH PRUTHI

ON the 30th November 1953, Dr. Hem Singh Pruthi, Plant Protection Adviser to the Government of India, and Director, Locust Control, proceeded on leave preparatory to retirement. The event marks not only a change in his personal career but also a stage in the development of entomological research and plant protection in this country.

Dr. Pruthi's early researches dealt with the morphology of some Rhynchota and Coleoptera and while at Cambridge he also studied the influence of chemical and physical conditions of water on aquatic animals, a line of research which he continued in the Zoological Survey of India at Calcutta. At the Indian Agricultural Research Institute, the study of crop and other pests and the methods of their control naturally engaged his major attention. Part of his researches also concerned the insect vectors of virus diseases of plants, a subject, which had received hardly any attention in India before. He worked and guided others so as to produce valuable contributions to the biology, ecology, systematics and control of pests of cotton, sugarcane, fruit trees, etc. Two of his notable monographs have been on the desert locust and pests of stored grains. While his distinguished predecessor, Mr. T. Bainbridge Fletcher, was a great Systematist, Dr. Pruthi may be regarded as a pioneer in many fields of research designed to provide basic information for solving the problems of pest control in different parts of India. In 1943, the University of Cambridge conferred on him its Sc.D. Degree for his researches carried out in India.

Dr. Pruthi was largely responsible for the establishment of the Locust Warning Organization established by the Government of India in 1939 and he was put in charge of it and remained so up till the time of his retirement.

During the last 25 years, Dr. Pruthi has been exercising an influence over entomological research and plant protection over a country of the size of the undivided India, to an extent to which it has not been given to many entomologists to do. Under his leadership entomological research in India began to be co-ordinated and the sciences of entomology, plant pathology and even of chemistry drew closer to solve practical problems. Entomologists all over India looked to him for inspiration and guidance and the subject of plant protection acquired new importance. His has indeed been a crowded life of persistent endeavours, effective planning and solid achievements. Few entomologists have had closer associations with Dr. Pruthi in his scientific work and endeavours than the present writer. The impression about Dr. Pruthi that survives with him, as it must be with many others, is of a forceful personality in which the scientist, the administrator, the organizer and the man of sympathy and understanding are happily blended. It is fortunate, therefore, that Dr. Pruthi's retirement from Government service does not mean his retirement from active scientific life and work and all of us must wish him many more years of good health in the cause of scientific research and crop protection.

K. B. LAL.

CENTRAL LABORATORIES FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, HYDERABAD (DN.)

THE Central Laboratories for Scientific and Industrial Research, Hyderabad (Dn.), which was recently declared open by Shri Pandit Jawaharlal Nehru, Prime Minister of India, aims at furthering the work of the National Laboratories on a regional level and has the following functions: to help and encourage the development of Hyderabad State by organized scientific and industrial research through (a) exploration of the possibilities of industrial utilization of the indigenous raw materials of Hyderabad State; (b) devising methods for the expansion of existing industries, and formulating plans for the starting of new industries, by carrying out experimental work on a pilot plant scale in the laboratories.

The main purpose of the Laboratories is to carry out developmental research of an industrial nature covering the fundamental as well as applied aspects of each problem. Research problems taken up for investigation are initially put forward by Research Committees, Government Departments of Industries, or are brought up during discussion between the Director and research workers. The problem is discussed in detail in the Operational Research Unit and a decision taken regarding its importance and feasibility. Subsequently, information relating

to the availability of raw materials, demand for finished products, their market prices, etc., is collected and a Literature Note is prepared incorporating all the data available. This note is discussed anew by the Operational Research Unit and a detailed programme of work with a time target is drawn up. On successful completion of the laboratory investigation, the Pilot Plant Committee studies the chemical engineering aspects of the problem in its translation to the pilot plant stage, and prepares a non-technical note with approximate costings, for circulation among interested industries. Pilot plant experiments are then undertaken either in the Laboratories or by industries, and an industrial process is evolved on the basis of these trials. The Pilot Plant Schemes are also sent to the various specialized bodies of the Government of India, like the Indian Central Oilseeds Committee, the Council of Scientific and Industrial Research, the National Research Development Corporation and others.

In the selection of the research programme, every effort is made at all stages, to co-ordinate the work with that of the National Laboratories, and care is taken to avoid unnecessary duplication of effort.

VIBROFLOTATION

SAND, which is normally a poor foundation for large heavy buildings, can now be made to serve as a satisfactory base by a new process called "vibroflotation", which increases the relative density of the soil by compacting and compressing into a dense mass. The device consists of a tube which is vibrated by an internal electrically driven eccentric producing a 10-ton centrifugal force. This apparatus is attached to a follow-up pipe which houses the water mains and electric lines. In operation, the Vibroflot is suspended from a crane and guided by vertical wooden leads. Vibrating at full speed, it is lowered into the sand while a water jet at its tip forms a saturated mass of sand or temporary "quick-sand" condition, into which the vibrator rapidly sinks. The device pounds the sand surrounding it into a

tighter mass on all sides. Fresh sand is shovelled in from above to fill the extra space which is formed by compaction. The vibrator is withdrawn in 1-foot stages. Tightly compacted columns of sand, 8-10' in diameter, are formed, which are pounded in a pre-determined overlapping pattern with about 8' between centres. The pattern, resulting in a relative density of 70-100 per cent, greatly strengthens the compacted mass.

The technique has a promising future in the construction of earth dams, coffer-dams, levees, airports in sandy areas, and heavy industrial plants which contain vibrating equipment. Another special use is in water-retaining dams and underwater structures where vibroflotation concrete can create unusually tight structures. (By courtesy of *USIS Engng Newsletter*.)

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LATE PRE-CAMBRIAN GLACIATION IN CENTRAL INDIA—A REJOINDER*

V. S. DUBEY AND M. S. CHAUDHARY in their paper entitled "Late Pre-Cambrian Glaciation in Central India" (*Current Science*, December, 1952, Vol. 21, pp. 331-32) have, in their anxiety to prove glaciation in this period, stretched the available evidence too far. I have devoted considerable time in field work in the Son Valley and the Bijawar type area, and my own observations do not support the conclusions arrived at by the above authors. As far as I can see, the basal conglomerate of the Semri Series

(Lower Vindhyan) is undoubtedly not a tillite. The evidence given by Auden¹ about its non-glacial origin is complete and these authors have not brought out any fact which would lead one to suppose that it is otherwise. The presence of fresh feldspars in the matrix is not in itself a conclusive evidence of its glacial origin. It is also contradicted by the above authors' own remarks that the Basal Semri bed is a fine-grained silicious rock and that the conglomerate merges into a coarse-grained quartzite at the top. The rock described by Oldham, et al.² referred to by Dubey and Chaudhary appears to be a tillite, but it occu-

pies a horizon other than the Basal Semri (and may possibly be equivalent to the Bijawars). Hence their grouping the two together in one and the same horizon is erroneous. It may also be noted here that the maximum distance between the Banas and the Gopath rivers is about 60 miles and not 100 miles as stated by the aforementioned two authors.

That the formation below the Semris in the Ken Valley is a tillite appears to be reasonably certain. The above two authors say that this tillite occupies a position "just below the Semri Series and overlying the Bijawars". They do not categorically state to what system this Ken Valley tillite should be assigned, but it is obviously implied that they would group it along with the Semris. From a careful examination of the area, however, it is abundantly clear that there is a distinct unconformity between the tillite and the overlying sandstone, and there can be no question of putting the two together in the same system. I consider that the tillite should be grouped with the underlying beds and assigned to the Bijawars, and that it was formed when the Bijawar period was coming to a close.

It would thus be seen that whereas in the Son Valley the conglomerate bed, being conformable with the overlying sediments, is a part and parcel of the Semri Series, that in the Ken Valley is conformable with the Bijawars; and the two conglomerates are not of a common horizon. Lithologically also it is to be noted that the two are very different from each other, as has also been noted by the authors themselves. Furthermore, the Son Valley Basal Semri conglomerate was formed by the action of water; while the Ken Valley rock is of glacial origin.

It occurs to me that Dubey and Chaudhary's contention that the Ken Valley glaciation took place in the "late Pre-Cambrian" times is also rather premature. The age and stratigraphical position of the Bijawars are uncertain even now; and unless they are fixed with a reasonable degree of accuracy, it would be unwise to make any categorical statement.

I have had the inestimable advantage of discussing this subject with Dr. A. G. Jhingran, Superintending Geologist, Geological Survey of India, to whom I offer my most sincere thanks. Geological Survey of India, S. M. MATHUR.
Lucknow, November 6, 1953.

* Published by permission of the Director, Geological Survey of India.

1. Auden, J. B., *Mem. Geol. Surv. India*, 1933, **62**, 2.
2. Oldham, R. D., Datta, P. N. and Vredenburg, E., *Ibid.*, 1901, **31**, 1.

UNIT CELL AND SPACE GROUP OF MORELLIN

MORELLIN, an antibiotic from *Garcinia morella*,¹ can be obtained by repeated crystallisation in the form of orange coloured needles and having a melting point of approximately 157° C. To Mr. S. C. L. Verma, the author's thanks are due for the loan of these crystals as well as for the density determinations. No previous optical or structural studies have been made of these crystals.

Goniometric studies using a Unicam two-circle optical goniometer indicated a symmetry 4 or 4/m for these crystals, the needle axis being the four-fold axis. The prism zones commonly observed are {100} and {210} with this symmetry. Laue oscillation and Weissenberg photographs with X-ray beam both perpendicular and parallel to the needle axis confirmed the point group as 4/m. The measurements of these photographs gave the following values for the unit cell dimensions

$$a = b = 15.89 \pm 0.04; c = 11.60 \pm 0.02 \text{ \AA.}$$

These values, along with the density 1.234 for these crystals, give the molecular weight of morellin to be 2176/Z where Z is the number of molecules per unit cell. Taking Z to be 4, we get the value 544 for the molecular weight. The value measured by chemical methods was 483 whereas the suggested formulae $C_{30}H_{34}O_6$ and $C_{29}H_{32}O_5$ give the molecular weight 490 and 476 respectively.¹ The X-ray molecular weight 544 (which has an accuracy better than ± 10) is thus definitely higher. This discrepancy must be cleared up and is being looked into by Dr. P. L. N. Rao and Mr. S. C. L. Verma (personal communication).

Detailed indexing of all the reflections in the $hk0$, hkl and $0kl$ Weissenberg photographs indicated no systematic general absences showing that the lattice is primitive. However, the only observed 00l reflections were the 004 and 008. This suggests that the space group is $C_{4h}^2 = P4_2/m$. Since there are eight general equivalent positions for this space group, the molecule must possess either a reflection plane or a two-fold rotational axis. As the molecule is found to be optically active it is probable that it is the rotational symmetry that is present.

The author's thanks are due to Dr. G. N. Ramachandran for his guidance.

Dept. of Physics, Gopinath Kartha,
University of Madras,
Madras-25, December 8, 1953.

1. Rao, P. L. N. and Verma, S. C. L., *J. Sci. Ind. Res.*, 1952, **11B**, 206.

**SIDEROLITES FROM THE CRETA-
CEOUS ROCKS NEAR ARIYALUR
(S. INDIA)**

In the paper on the 'Orbitoids from the Cretaceous Rocks near Ariyalur' recently published by the author in *Current Science* (Sep., 1953), the occurrence of abundant remains of *Siderolites* in these rocks along with the Orbitoids, was reported. These have now been examined in a general way, and the main observations are briefly recorded in the present note.

fauna occurs abundantly in the basal part of the 'Dunghan' limestone in Quetta, and the hilly regions in North-Western Baluchistan.

Some of the common forms of *Siderolites* noticed in the Ariyalur material now under study are shown in the following microphotographs (Figs. 1-6); and it may be mentioned that these few photographs hardly do justice to the abundance and variety of these fossil forms noticed in the entire collection. The six examples figured now are more or less meridian sections and give a good idea of the shape,

FIG. 1 $\times 22$



FIG. 2 $\times 16$



FIG. 3 $\times 28$



FIG. 4 $\times 24$



FIG. 5 $\times 26$



FIG. 6 $\times 26$

The 'rare' presence of *Siderolites* in the Ariyalur rocks was first mentioned by S. R. N. Rao about 12 years ago¹; R. S. Sharma has more recently found this fossil in the Upper Cretaceous beds of the Pondicherry area.² In both cases, just a mention has been made of the occurrence and no descriptions have been given. It is also understood from the geologists of the Pakistan Petroleum Ltd., that *Siderolites* associated with typical Maastrichtian

size and mode of arrangement of the chambers, as also of the spines which form such a characteristic and striking feature.

It must, however, be pointed out that in almost all these cases the fossil is incomplete, chiefly in the sense that the outermost whorl of chambers, surrounding the 'body', and often also the 'spines', is missing; its presence in the entire form, however, is clearly indicated in cases where the fossil, relatively speaking, is

better preserved. One important point which comes out very clearly in all these cases is that the 'spines' are not mere outgrowths from the peripheral portions of the 'supplemental skeleton' but are more deep-rooted, arising almost right from the centre. The prominent 'pillars' which also proceed from the centre, and appear as knobs on the two sides of the test are very well seen in some of the sections. In addition to these spines and pillars, the outer walls of the chambers possess a finely granular ornamentation presenting, in sections, a nice 'pectinate' appearance, and the walls of the chambers themselves frequently show a transversely fibrous structure. All these features which can be seen in one or the other of the above photographs make this foraminifer a most striking and impressive form.

In the meridian sections which pass right through the centre, we get a good idea of the nature and disposition of the earlier chambers, and a detailed examination of this region (in both meridian and equatorial sections) is of the greatest importance; in fact, the sharp difference of opinion regarding the systematic position itself of *Siderolites*—whether it belongs to the Camerinidae or the Calcarinidae—arises from differences in the views held regarding the arrangement of these early chambers, as to whether they are planispiral or rotaline. Luckily we have in our material quite a number of sections showing these central chambers, and a careful study of these to determine if all of them are uniformly of one kind or the other will obviously be of great value in the elucidation of this problem. The recent proposal of Hanzawa³ arising from his studies of certain Cretaceous and Tertiary Foraminifera from the West Indies to erect a new family—Pellatispiridae, intermediate in position between the Camerinidae and the Calcarinidae, makes the position even more interesting. A comparison of some of our sections with those of *Pellatispirella* figured by him show some striking similarities. It looks as though we have now to consider the whole question of the affinities of *Siderolites* vis-a-vis the Camerinidae, Calcarinidae and Pellatispiridae. In this connection the study of the nature of the canal system in these groups becomes necessary.

Another important aspect of the study of *Siderolites* is in relation to the foraminiferal genus *Miscellanea* proposed by Pfender⁴ and to which she transferred quite a number of fossils from the Paleocene and Lower Tertiary beds previously described by Douville, Nuttall, Davies and others as *Siderolites miscella*. In this valuable paper, Pfender has pointed out

the reasons for such a change, and has also published nice figures of true *Siderolites* and her new *Miscellanea*, together with those of *Rotalia* cf. *trochidiformis* referred to in her discussion. Whether Pfender's work implies that there is no true *Siderolites* at all in the Lower Tertiary beds is a point for consideration; such a suggestion would probably be not correct.*

From what has been said above it is evident that the study of *Siderolites* and its associated many-sided problems is of great interest. We know very little of this fossil from India, and no detailed descriptions and figures are available. In the material now under study, there is a rich collection of a variety of these forms, and we get all possible sectional views ranging from the truly meridian to those which are nicely equatorial; and since these fossils are so abundant in some specimens of the sandstone, it should also be possible to disintegrate the rock and separate the shells for examination. It is thus obvious that here we have excellent scope for comprehensive studies which may be expected to throw valuable light on the many interesting aspects of this important fossil.

This work is under progress, and a full paper will be published shortly.

Bangalore,

L. RAMA RAO.

December 11, 1953.

* In one of the rocks from the Pondicherry area which I am now examining, several fine sections of *Siderolites* have also been noticed. These seem to be different from the forms now being described from Ariyalur. It is now well known that in the Pondicherry area we have some lower Eocene beds also in addition to the Cretaceous series. The question of the exact age of this *Siderolites*-bearing rock from Pondicherry is under investigation. (1-1-1954).

1. Rao, S. R. N., *Jour. Mys. Uni.*, 1941, 2, Pt. 9.

2. Sharma, R. S., *Curr. Sci.*, 1953, 22, 12.

3. Hanzawa, *Jour. Pal.*, 1937, 11, 113.

4. Pfender, *Bull. Soc. Geol. France*, 1934, 4, 231.

WALL-ROCKS FROM MANGANESE QUARRIES OF VISAKHAPATNAM AND SRIKAKULAM DISTRICTS

MINERALOGICAL constitution and textural features of wall-rocks from manganese quarries collected by the author from Gotnandi (Long. 83° 36'; and Lat. 18° 31'), Garraju Chipurupalle in Srikakulam District, and of Gotivada (Long. 82° 44'; and Lat. 17° 33') collected by Prof. C. Mahadevan in Visakhapatnam District, are of particular interest in that they are similar to

the manganese-bearing rocks of Madhya Pradesh (C.P.).

The Gotnandi specimen is a fine-grained, dark manganese-bearing quartzite, consisting of quartz and manganese ore. The quartz grains vary in shape and size, the interstitial space being occupied by manganese ore. Under the microscope, it has brecciated appearance indicative of crushing and recrystallization (Micro-photo). The wall-rock from Gotivada manganese quarry is equigranular and fine-grained,



Qs.—Quartz. Black-Mn. ore

and consists of quartz and manganese-garnet in equal proportions. Coarse-grained rock types of this nature occur in the abandoned manganese quarries of Garraju Chipurupalle, 1½ miles east of Gotnandi, while in the quarry which is now being worked, pink and red garnets occur abundantly, which show progressive alteration to manganese ore. The texture is typically gneissic. The manganese quartz rocks of Gotnandi and the quartz manganese garnet-gneisses of Gotivada and Garraju Chipurupalle may represent the varying nature of original manganese deposition. The arenaceous sediments with associated manganese might have

given rise to quartzites rich in manganese, and the impure argillaceous manganese-bearing sediments are presumed to have formed garnet-gneisses on metamorphism. These rocks are similar to the 'Gondites' of Madhya Pradesh in that both are primarily manganese-bearing sediments, later metamorphosed. The absence of apatite and potash feldspar from both the ore body and the wall-rock in these localities appears to go against the suggestion of Fermor¹ that the intrusive 'Kodurites' are responsible for the manganese deposits of Visakhapatnam. A detailed paper on the wall-rock alteration of these deposits will be published elsewhere.

I am thankful to Prof. C. Mahadevan for his interest in the work.

Dept. of Geology, J. S. R. KRISHNA RAO.
Waltair, November 23, 1953.

1. Fermor, L. L., *G. S. J. Res.*, **39**, 160, 161.

MICROFOSSILS FROM THE DOGRA SLATES (PRE-CAMBRIAN) OF KASHMIR

The name Dogra slates was applied by D. N. Wadia¹ to a prominent belt of slates, which form the south-west flank of Pir Panjal and Dhauladhar ranges of the Kashmir Himalaya. These show a transitional passage into the overlying fossiliferous Cambrian beds and have been hitherto regarded as unfossiliferous. Their stratigraphical position and probable equivalents, according to him, are as follows (see Table I below).

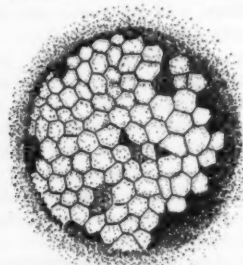
Specimens of the Dogra slates collected from Baramula (34-35° : 74-75°) by one of the present authors have been examined for microfossils. Thin sections when examined under the microscope revealed obscure organic remains, which, on further examination under the phase-contrast microscope showed sufficient details for identifying some of them as radiolaria and some as doubtful algal remains.

TABLE I

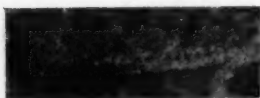
Kashmir	Hazara	Spiti-Simla	Ages
Cambrian of Hundawar and Lidar with <i>Lingulella</i> , <i>Agnostus</i> and <i>Ptychoparia</i> 5,000 ft.		Haimanta system	Cambrian
Lower Cambrian of Shamsh Abari 3,000 ft.	Hazara and Attock slates	Simla slates	? Lr. Cambrian
Dogra slates (passing conformably into Lower Cambrian) 5,000 ft.			Torridonian
Salkhala series (Many thousands of feet thick)	Nonconformity Salkhala series	Jutogh and Chail series, Aigoukian Vaikrita series	

687261

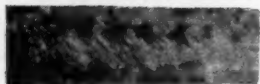
The rock examined is fine-grained, argillaceous, with generally oblique cleavage, phyllitic, with occasional gritty layers, and blue-



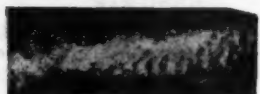
1



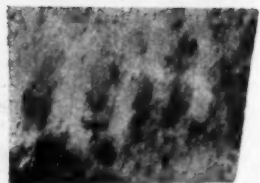
2



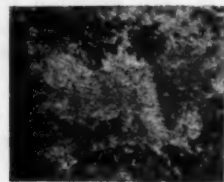
3



4



5



6

FIG. 1. Camera lucida drawing of a Radiolarian test under the phase-contrast microscope, $\times 640$.

FIG. 2. Dasycladacea, $\times 50$.

FIG. 3. Dasycladacea. Portion of Fig. 2 further magnified to show the sporangia, $\times 170$.

FIG. 4. Dasycladacea, $\times 45$.

FIG. 5. Dasycladacea. Portion of Fig. 4 further magnified to show the sporangia, $\times 170$.

FIG. 6. An indeterminate fossil, $\times 45$.
(Photos 2-6 are under the phase-contrast microscope.)

grey to dark in colour. There are no signs of marked metamorphism. The rock is devoid of mega-fossils.

Fig. 1 represents the common type of radiolaria found in this rock. The skeleton is spherical, honey-comb like, smooth, single lattice-sphere with sub-angular to hexagonal unequal pores, 9 to 13 pores across diameter of sphere, polar spines not preserved, diameter of sphere ranging from $32-85\mu$ in various sections. The medullary sphere is not distinct. The pores are sometimes filled up by a dark almost opaque substance, having diameter of $6-7\mu$ in the bigger specimens. Radiolarians have been reported from rocks ranging in ages from the Pre-Cambrian to Recent. They are common in Pre-Cambrian quartzites interbedded with gneiss in North-Western France.²

Figs. 2 & 3: These appear to be fragments of the thallus of a *Dasycladacea*. Sporangia are represented by black rounded bodies of $12-20\mu$ in diameter arranged in linear series.

Figs. 4 & 5: These are also algal remains. The sporangia, which are elongated, vary in thickness from $29-40\mu$.

Fig. 6: This is an indeterminate fossil with fine wavy parallel striations.

The present study indicates that the Dogra slates are fossiliferous and it is hoped that further investigations in progress may yield micro-palaeontological data of sufficient importance in fixing the age of the beds.

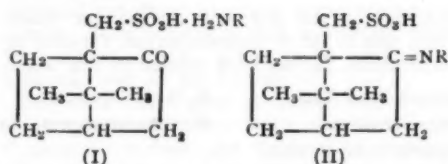
We are grateful to Dr. B. Mukherji, Director, Central Drug Research Institute, Lucknow, for providing us facilities for the use of phase-contrast microscope.

Dept. of Geology, S. R. N. RAO.
University of Lucknow, KRISHNA MOHAN.
Lucknow, October 20, 1953.

1. Wadia, D. N., *Mem. Geol. Surv. Ind.*, 1928, **51**, pt. 2; *Rec. Geol. Surv. Ind.*, 1931, **65**, pt. 2; *Geology of India*, 1949.
2. Moore, Lalicker and Fischer, *Invertebrate Fossils*, 1952, 75.

CONDENSATION OF REYCHLER'S ACID WITH O-PHENYLENEDIAMINE

THE crystallisation of the condensation product of o-phenylenediamine with d-camphor-10-sulphonic acid when taken in molar proportions presented some difficulties. Initially, a white crystalline compound separated and this gradually changed its colour to deep orange when repeatedly crystallised out of a mixture of ethyl acetate and ethyl alcohol. Presumably this deep orange compound is of the Ketimine form (II) whose formation has been proposed^{1,2,3} to explain the mutarotation of the primary amine salts (I) of Reychler's acid.



This orange yellow compound melts at 168-69° C. and is very soluble in water, ethyl alcohol and methyl alcohol. The aqueous and alcoholic solutions are deep orange in colour. The aqueous solution has been found to give characteristic colours in acidic and alkaline media—being orange in acid and yellow in alkaline solutions. Further, a few drops of 1 per cent. aqueous solution of this compound can serve as a sensitive indicator for acid-base titrations. It may be used in titrations of strong acids against strong alkalis and weak acids against strong alkalis. The titre values were the same as those obtained when methyl orange and phenolphthalein were employed as indicators. The colour changes have been found to be complete within a pH range of 6.4 to 7.6. The pH value of its 1 per cent. aqueous solution at 30° C. is 3.0.

It may be pointed out that freshly prepared condensation products of d-camphor-10-sulphonic acid with *m*- and *p*-phenylenediamines do not show colour variations with changes in pH of the medium. The analytical data shows that these two salts belong to the normal form (I).

(*o*-Phenylenediamine salt: m.p. 168-69° C., Found: C, 59.78; H, 6.65; N, 9.02; S, 9.73. $\text{C}_{16}\text{H}_{22}\text{N}_2\text{O}_3\text{S}$ requires C, 59.62; H, 6.08; N, 8.70; S, 9.94. *m*-Phenylenediamine salt: m.p. 173-75° d. Found: C, 56.83; H, 6.76; N, 8.70; S, 9.58. *p*-Phenylenediamine salt: m.p. 180-85° d. Found: C, 56.72; H, 7.43; N, 8.08; S, 9.27. $\text{C}_{16}\text{H}_{24}\text{N}_2\text{O}_3\text{S}$ requires C, 56.46; H, 7.06; N, 8.23; S, 9.41.)

Our heartiest thanks are due to Dr. A. K. Bhattacharya for providing research facilities.

MAGHAR SINGH MANHAS.
ARVIND VINAYAK MAHAJANI.

Chemistry Dept.,
University of Saugar,
Sagar, M.P., April 16, 1953.

AN ANTI-B BLOOD GROUPING REAGENT PREPARED FROM SOYA BEANS

NON-SPECIFIC agglutinins for human red cells are present in soya beans (*Glycine soja*).¹ The agglutinins are active at low temperatures (6-10° C.) but not at laboratory temperature (30° C.).

When absorbed with O cells in the cold, the action of these agglutinins upon A and B cells is increased both in titre and in thermal amplitude. A and B cells are now agglutinated at laboratory temperatures. Absorption with A cells results in loss of activity for both A and O cells with enhanced activity against B cells. Similarly, absorption with B cells results in loss of activity for both B and O cells with enhanced activity for A cells.

The antibodies present appear to be a combination of anti-H, anti-A and anti-B. The enhanced action against A and B cells is similar to that observed in certain human sera containing cold agglutinins predominantly specific for O cells.^{2,3}

So far specific anti-A and anti-O antibodies have been demonstrated in certain seeds. No seed antibodies specific for B cells have been described. Attempts to prepare a specific anti-B reagent from seeds containing non-specific agglutinins by absorbing them with O and A cells have resulted in the removal of all agglutinins.

However, complete absorption of *Glycine soja* extracts, prepared as previously described,⁴ with O and A cells yields a reagent specific for B cells. This absorbed extract agglutinates B cells to a titre of 2 by the tile method, and 32 by the tube method, at laboratory temperature. All of 100 samples of B cells were strongly agglutinated at laboratory temperature. Control A and O cells were consistently negative or very weakly positive at 4-6° C.

As the reagent is prepared by an absorption method and has a low titre it is doubtful if it will find favour as a routine blood-grouping reagent. A detailed report, dealing particularly with the phenomenon of the post-absorption enhancement, will appear elsewhere. This phenomenon is considered to be of possible importance in studies of antibody properties.

Blood Transfusion Dept., G. W. G. BIRD.
Armed Forces Medical College,
Poona, October 22, 1953.

- Schreiber and Shriner, *Jour. Amer. Chem. Soc.*, 1935, **57**, 1306, 1445, 1896.
- Singh, Pertil and Singh, *Proc. Lahore Phil. Soc.*, 1944, **6**, 15; Singh and Pertil, *Proc. Ind. Acad. Sci.*, 1945, **22A**, 84, 265.
- Singh and Manhas, *Ibid.*, 1947, **26**, 61; 27, 1.

- Bird, G. W. G., *Curr. Sci.*, 1953, **22**, 273.
- , *Lancet*, 1951, **2**, 128.
- , *Brit. J. exp. Path.*, 1953, **34**, 131.
- Boyd, W. C. and Reguera, R. M., *J. Immunol.*, 1949, **62**, 333.

THE NUTRITIVE VALUE OF DIFFERENT VARIETIES OF SWEET POTATO

SWEET POTATO (*Ipomea batatas*), believed to be a native of South America, is now cultivated throughout the tropics and subtropics and in some temperate regions. The varieties commonly grown are of two types: one having orange flesh and the other white.¹ The white flesh variety is widely cultivated in India, while in U.S.A. the orange variety is widely grown and consumed.² Recently, attempts have been made to grow the orange flesh variety of sweet potato in experimental farms in India.³ The present paper deals with the chemical composition of three American orange flesh varieties and two local white flesh varieties.

supplying us the different varieties of sweet potato, and to Dr. V. Subrahmanyam, Director of this Institute, for his keen interest in this work.

Central Food Tech. H. B. N. MURTHY.

Res. Institute, M. SWAMINATHAN.

Mysore, June 1, 1953.

1. Winton, A. L. and Winton, K. B., *Structure and Composition of Foods*, 1935, 2, 102.
2. Ezell, B. D. and Willcox, M. S., *Food Research*, 1948, 13, 203.
3. Sen, B., *Indian Farming*, 1949, 10, 288.
4. Association of Official Agricultural Chemists, *Official Methods of Analysis*, 7th Edn. 1950.
5. Association of Vitamin Chemists, *Methods of Vitamin Assay*, 2nd Edition, 1951, 52.
6. Subrahmanyam, V., Swaminathan, M. and Murthy, H. B. N., *J. Sci. Ind. Res.*, 1950, 9B, 135.

TABLE I

Chemical composition of different varieties of sweet potato

Variety	Moisture %	Protein %	Fat %	Fibre %	Mineral matter %	Carbohydrate % (by difference)	Caloric value per 100 g.	Calcium mg.	Phosphorus mg.	Carotene %
1 Local variety, pink skin (white flesh)	66.8	1.5	0.3	1.6	1.0	28.8	124	34.5	62.2	nil
2 Local variety, white skin (white flesh)	65.6	2.6	0.4	1.7	1.3	28.4	128	72.0	74.6	nil
3 American variety (orange flesh) 5999	71.5	2.8	0.3	1.4	1.0	23.0	106	101.6	71.5	7.2
4 American variety (orange flesh) 5941 B	73.2	2.6	0.2	1.3	0.9	21.8	99	104.8	72.1	5.4
5 American variety (orange flesh) L 240	70.5	3.1	0.3	1.4	1.0	23.7	110	52.0	68.4	5.8

The sweet potato used in these studies was grown in Bangalore. The samples were received in good condition immediately after harvesting. The determination of the proximate principles and minerals were carried out by the methods of A.O.A.C.⁴ Carotene was determined according to the method of the Association of Vitamin Chemists.⁵ The results are presented in Table I.

It is evident from the results that the American varieties of sweet potato are very rich in carotene in contrast to the local varieties, which are completely devoid of the same. Attempts are being made to increase the cultivation of sweet potato in order to utilize it as a subsidiary food.⁶ It would appear from the results that introduction of the American varieties in preference to the local varieties would help to improve the nutritional quality of our diet, particularly the vitamin A content.

Our thanks are due to the Superintendent of the Lal Bagh Gardens, Bangalore, for kindly

MORPHOLOGY OF THE COMMON INDIAN HOUSE-FLY, *MUSCA* (S. STR.) *DOMESTICA NEBULO* FABRICIUS

WEST¹ has reviewed the work done on different house-flies. Some of the significant observations on the morphology of the Indian house-fly are incorporated in this note.

- (1) The body of the male is more setose.
- (2) The thoracic stripes in the male are fused on the scutellum, whereas they are free in the female.
- (3) The abdominal stripe of the male is broader and complete.

In both the sexes, the compound eyes, possess, along with the hexagonal ommatidia, a variable number of square ommatidia, arranged in rows of four, only in the central region of the eye. The labellum bears 33 pseudotracheæ, which are arranged in sets of 3. The anterior set consists of 10 pseudotracheæ, the central of 6 and the posterior of 17. Two malpighian tubules are situated at the junction of the

proximal and distal intestines. There are 4 rectal glands. Each is conical with a swollen, circular perforated base, which is in continuation with the wall of the rectum.

The male has 2 pairs of thoracic and 7 pairs of abdominal spiracles, while the female has 2 pairs of thoracic and 5 pairs of apparent abdominal spiracles. All the 3 thoracic nerve ganglia fuse to form a compound ganglion. The abdominal ganglion lies touching this, and sends posteriorly the abdominal nerve. No accessory glands are present in the male. The female has 3 spermathecae, a pair of accessory glands, and the copulatory pouches. Two spermathecae are on the left side and one on the right, held together by a thin-walled sac, their ducts opening near the posterior end of the sacculus.

Further details are being published elsewhere.

We are thankful to the Director, M.A.C.S. Laboratory, Poona, for the facilities placed at our disposal to conduct these studies during 1949-51.

Haffkine Institute,

Parel, Bombay-12,

November 11, 1953.

P. J. DEORAS.

D. R. RANADE.

I. West, L. S., *The House Fly*, 1951, Comstock Publishing Co., New York.

INFLUENCE OF FEEDING PENICILLIN ON INTESTINAL THIAMINE SYNTHESIS

RECENT studies¹⁻⁸ indicate that feeding certain antibiotics stimulates the growth of rats and other experimental animals particularly when the basal diet contains limiting amounts of B-complex vitamins. The effect of these drugs

on the intestinal flora of the animals has also been studied to some extent.⁹⁻¹³ We carried out some studies to determine the mechanism of growth-promoting action of the antibiotic and its influence on thiamine synthesis. These observations are reported here.

Twenty-four rats weighing about 50 g. each were divided into four comparable groups (A, B, C and D) of six rats each. Rats of A and B groups were given a poor South Indian diet.¹⁴ Animals of C and D groups were fed a synthetic diet consisting of starch (64 per cent.), sugar (10 per cent.), vitamin-free casein (12 per cent.), salt mixture (4 per cent.) and groundnut oil (10 per cent.). Daily vitamin B₁ intake of each rat was restricted to 5 gamma in all the groups. Each rat received daily 50 gamma of riboflavin, 50 gamma of calcium pantothenate, 10 gamma of nicotinic acid, 10 gamma of pyridoxine and 1 mg. of choline. Two drops of adexolin were supplied to each rat twice a week. Penicillin, mixed with the diets, was fed to the rats of B and D groups at a level of 0.5 mg. per rat per day. Weekly growth rates, urinary and faecal thiamine excretions, liver stores of thiamine and faecal and caecal flora of the different groups of animals were followed. The methods employed for the estimation of thiamine in urine, faeces and liver were those of Mawson and Thompson,¹⁵ 'Vitamin Assay'¹⁶ and Greenberg and Rinehart¹⁷ respectively. Enzyme digestion using taka-diastase was carried out in the cases of faeces and liver.

The techniques of Miller¹⁸ and Nath¹⁹ et al. were adopted for the bacteriological examination of the faecal flora and caecal flora respectively.

The results obtained are summarised in the following table.

TABLE

Data	Poor South Indian diet	P.S.I.D. + penicillin	Synthetic diet	Synthetic diet + penicillin
1 Net increase in wt. (6 weeks) g.	21.3 ± 0.7	36.7 ± 0.6	38.8 ± 0.8	66.2 ± 1.1
2 Weekly excretion of thiamine (gamma)				
urine	3.5 ± 0.2	5.7 ± 0.2	6.0 ± 0.2	10.2 ± 0.3
Total faeces	3.4 ± 0.1	5.6 ± 0.1	2.8 ± 0.2	5.2 ± 0.2
3 Liver thiamine in gamma.	3.1 ± 0.1	5.0 ± 0.2	3.8 ± 0.1	6.5 ± 0.3
4 Faecal flora:—Total counts/g. of faeces in 10 ⁵	12.7	6.2	17.3	7.3
Coliform counts/g. of faeces in 10 ⁴	13.3	11.7	11.7	12.0
5 Caecal flora:—Total counts/g. of caecal contents in 10 ⁶	2.6	1.1	3.0	1.4
Coliform counts/g. of caecal contents in 10 ⁵	1.3	1.1	7.0	7.8

It could be seen that oral administration of penicillin has resulted in marked growth stimulation, enhanced thiamine excretions and also higher liver thiamine stores as compared to the control groups.

A consideration of the faecal and caecal flora indicates that the increased benefit derived by the groups of rats fed penicillin is perhaps not due to increased thiamine synthesis as the coliform organisms have not recorded any increase. *In vitro* studies were carried out to elucidate whether as a result of penicillin treatment, even without substantial increase in the number, the coliform bacteria were toned up to synthesise more thiamine or whether penicillin killed out other bacteria competing with the host for the available thiamine. The total count of the faeces and caecal contents recorded in the table shows that the mechanism of the antibiotic action is by eliminating the thiamine utilising bacteria, thereby making available to the host the entire thiamine supplied in the diet and also synthesised in the intestinal tract. The *in vitro* studies have given convincing evidence to the fact that there is no increased synthesis of thiamine due to penicillin feeding and that consequent on the reduction of the other types of bacteria, the rat has had more thiamine for its growth. Studies were also carried out to find out whether parenteral administration of penicillin would evoke similar response. It was found that such a method had no beneficial influence. The detailed paper will be published elsewhere.

The authors' thanks are due to Prof. K. V. Giri for his keen interest in this investigation.
 Dept. of Biochem. and S. BALAKRISHNAN.
 Pharmacology Lab., R. RAJAGOPALAN.
 Indian Inst. of Science, M. SIRSI.
 Bangalore-3, October 19, 1953.

1. Moore, B. R., *et al.*, *J. Biol. Chem.*, 1946, **165**, 437.
2. Oleson, J. J., Hutchings, B. L. and Whitehill, A. R., *Arch. Biochem.*, 1950, **29**, 334.
3. Stokstad, E. L. R. and Jukes, T. H., *Proc. Soc. Exptl. Biol. and Med.*, 1951, **76**, 73.
4. Lih, H. and Baumann, C. A., *J. Nutrition*, 1951, **45**, 143.
5. Monson, W. J., Dietrich, L. S. and Elvehjem, C. A., *Ibid.*, 1952, **46**, 411.
6. Sauberlich, H. E., *Ibid.*, 1952, **46**, 99.
7. Swick, R. W., Lih, E. and Baumann, C. A., *Federation Proc.*, 1951, **10**, 395.
8. Guggenheim, K., *et al.*, *J. Nutrition*, 1953, **50**, 245.
9. Siebarth, J. M., *et al.*, *Proc. Soc. Exptl. Biol. and Med.*, 1951, **76**, 15.
10. Anderson, G. W., Cunningham, J. D. and Slinger, S. J., *J. Nutrition*, 1952, **47**, 175.
11. Wahlstrom, R. C., Terrill, S. W. and Johnson, B. C., *Proc. Soc. Exptl. Biol. and Med.*, 1950, **75**, 710.
12. Johansen, K. R., *et al.*, *J. Nutrition*, 1953, **49**, 135.

13. Guzman-Garcia, Saries, W. B. and Baumann, C. A., *J. Nutrition*, 1953, **49**, 647.
14. Aykroyd, W. R. and Krishnan, B. G., *Ind. J. Med. Res.*, 1937, **25**, 367.
15. Mawson, E. H. and Thompson, S. Y., *Biochem. J.*, 1948, **43**, 2.
16. *Vitamin Assay*, by the Association of Vitamin Chemists—1947.
17. Greenberg, L. D. and Rinehart, J. F., *Proc. Soc. Exptl. Biol. and Med.*, 1945 **59**, 9.
18. Miller, A. K., *J. Nutrition*, 1945, **29**, 143.
19. Nath, H., Barki, V. H., Saries, W. B. and Elvehjem, C. A., *J. Bact.*, 1948, **56**, 783.

ROLE OF PYRIDOXINE IN TRYPTOPHANE METABOLISM STUDIED IN RICE MOTH LARVA (*CORCYRA CEPHALONICA* ST.)

PYRIDOXINE deficiency was found by Lepkovsky and Nielson¹ and then by Miller and Baumann,² to produce marked alterations in tryptophane metabolism. Later studies^{3,4} showed that pyridoxine deficient rats were unable to convert appreciable amounts of added tryptophane to nicotinic acid and its derivatives. Using desoxy-pyridoxine—the anti-vitamin of pyridoxine—Shanmuga Sundaram, Ranganathan and Sarma⁵ showed that pyridoxine had a definite role to play in the conversion of tryptophane to nicotinic acid in germinating pulses. Much work had been carried out using insects regarding the role of tryptophane metabolites in the production of eye pigments by Butenandt and his co-workers.^{6,7,8} In the case of rice moth larva, Sarma⁹ found that pyridoxine was one of the growth-promoting factors and that a yellow coloured compound was excreted when the rice moth larvae were fed pyridoxine deficient diets containing tryptophane. The yellow-coloured compound disappeared from the excreta on the addition of pyridoxine to the diet. The yellow compound did not answer the tests for xanthurenic acid. In order, therefore, to obtain further information on the role of pyridoxine in tryptophane metabolism in rice moth larva, a study was made on the total nicotinic acid present in the pyridoxine deficient and supplemented whole larvae, which were fed either tryptophane or kynurenine, or 3-hydroxy anthranilic acid.

The basal diet was prepared as described by Sarma.⁹ The pyridoxine deficient diet consisted of salt extracted wheat flour, sugar and salt mixture, together with vitamins thiamine, riboflavin and calcium pantothenate in the proportion 10, 5, 15 μ g. per gram of the diet respectively. As the conversion of tryptophane and its metabolites to nicotinic acid is to be studied by estimating the total nicotinic acid in the larvae, no

nicotinic acid was added to the diet. DL-tryptophane, DL-kynurenine sulphate and 3-hydroxy anthranilic acid were added to the diet at a level of 10, 5 and 3 mg. per g. of the diet respectively. The larvae which were feeding on whole wheat diet for a period of 10-12 days after hatching were removed, cleaned, weighed and placed in the pyridoxine deficient and supplemented diets containing tryptophane or its metabolites. They were picked out at regular intervals, weighed, crushed and hydrolysed with 1N sulphuric acid for 45 minutes in an autoclave at 15 lb. pressure. The total nicotinic acid was estimated by the microbiological method of Snell and Wright.¹⁰

That rice moth larva, normally synthesises nicotinic acid, as it grows on a whole wheat diet can be seen from Fig. 1. Table I gives the amount of nicotinic acid synthesised by pyridoxine deficient and supplemented larvae fed tryptophane, or kynurenine or 3-hydroxy anthranilic acid. From the results presented, it can be seen that in the case of pyridoxine deficient larva fed tryptophane and kynurenine the total nicotinic acid is much less than that contained in pyridoxine fed larva, showing thereby that pyridoxine deficient larvae are unable to convert appreciable amounts of added tryptophane and kynurenine to nicotinic acid. Further, in these two cases the larvae excrete yellow-coloured faeces. However, in the case of pyridoxine deficient and supplemented larvae fed 3-hydroxy anthranilic acid, the total nicotinic acid content are the same and no yellow-colour-

ed compound is excreted. As the yellow-coloured compound is not found to be xanthurenic acid confirming the earlier observations of Sarma,⁹ it is suggested that it may be 3-hydroxy kynurenine, which may be excreted out, as it

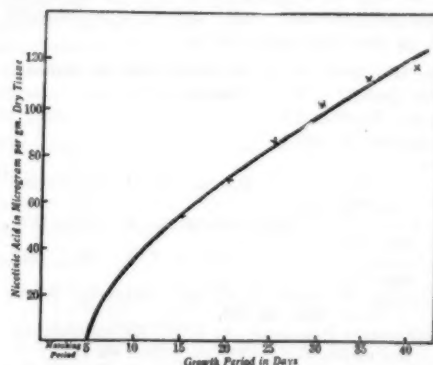


FIG. 1 Graph showing the synthesis of nicotinic acid by the rice moth larva reared on whole wheat flour.

gets accumulated during the deficiency state. From these, it is clear that the rice moth larva behaves in a manner analogous to mammals and the fungus *Neurospora crassa*, as regards tryptophane metabolism. Here also pyridoxine is concerned and its site of action from the data given is in between kynurenine and 3-hydroxy anthranilic acid. However, using circular paper chromatographic technique, it has been found qualitatively that the yellow-coloured compound

TABLE I

Nicotinic acid content of pyridoxine deficient and supplemented rice moth larva, fed tryptophane or kynurenine or 3-hydroxy anthranilic acid

Number of days in the experimental diet	DL-tryptophane 10 mg. per g.		* DL-kynurenine 5 mg. per g.		† 3-Hydroxy anthranilic acid 3 mg. per g.	
	Average weight of 20 larvae mg.	Nicotinic acid gamma per g. dry weight	Average weight of 20 larvae mg.	Nicotinic acid gamma per g. dry weight	Average weight of 20 larvae mg.	Nicotinic acid gamma per g. dry weight
Larva on pyridoxine added diet						
10	326	61.12	320	64.0	315	66.0
20	425	78.40	420	74.8	480	96.4
25	445	87.60	465	91.0	530	102.0
Larva on pyridoxine deficient diet						
10	211	44.60	240	46.0	302	63.2
20	270	53.60	295	58.0	430	90.5
25	291	59.20	320	63.0	480	94.0
	(Yellow excreta)		(Yellow excreta)		(No yellow excreta)	

* Kindly supplied by Dr. C. P. Berg, of the State University of Iowa (U.S.A.).

† Kindly supplied by Dr. B. S. Schweigert, American Meat Institute Foundation, Chicago (U.S.A.).

is 3-hydroxykynurenine.¹¹ Final confirmation should, however, await the actual isolation of 3-hydroxykynurenine from the yellow excreta in a pure state, but it can now be said definitely from the investigations detailed above that the site of action of pyridoxine is in between 3-hydroxykynurenine and 3-hydroxyanthranilic acid, in the rice moth larva.

Univ. Biochem. E. R. B. SHANMUGA SUNDARAM.
Res. Lab., P. S. SARMA.
Guindy, Madras-25,
November 17, 1953.

1. Lepkovsky, S. and Nielson, E., *J. Biol. Chem.*, 1942, **144**, 135.
2. Miller, E. C. and Baumann, C. A., *Ibid.*, 1945, **157**, 551.
3. Schweigert, B. S. and Pearson, P. B., *Ibid.*, 1947, **168**, 555.
4. Rosen, F., Huff, J. W. and Perlzweig, W. A., *J. Nutri.*, 1947, **33**, 561.
5. Shanmuga Sundaram, E. R. B., Ranganathan, G. and Sarma, P. S., *Curr. Sci.*, 1951, **20**, 122.
6. Butenandt, A., Weidel, W. and Becker, R., *Naturwiss.*, 1940, **28**, 63.
7. —, *Ibid.*, 1940, **28**, 447.
8. Butenandt, A., *Angew. Chem.*, 1949, **61**, 262.
9. Sarma, P. S., *Proc. Soc. Expt. Biol. and Med.*, 1945, **58**, 140.
10. Snell, E. E. and Wright, L. D., *J. Biol. Chem.*, 1941, **131**, 675.
11. Sundaram, T. K., Radhakrishnamurthy, R., Shanmuga Sundaram, E. R. B. and Sarma, P. S., *Proc. Soc. Expt. Biol. and Med.* (in Press).

THE CHROMOSOME NUMBER OF *RHODOTORULA GLUTINIS* AND ITS PROBABLE SIGNIFICANCE

Like the *Torulæ*, the *Rhodotorulæ* also have generally been assumed to be haploids because they are asporogenous.^{1,2} It was shown recently³ that the mitotic complement of *Candida utilis* consists of two chromosomes. Because a sporogenous brewery yeast was demonstrated earlier^{4,5,6} to have the same chromosome number, it was suggested that *Candida utilis* may be a diploid hybrid. On the same argument, it appeared to us that *Rhodotorulæ* may also be infertile diploid hybrids. To settle this question, the cytology of *Rhodotorula glutinis* (Fres.) Harrison var. *rubescens* (Saito) Lodder was investigated.

Mitosis is just one phase of behaviour of the yeast nucleus⁷ and is exhibited only under certain specified conditions. Its demonstration, therefore, necessitates considerable experimentation and as such is not as easy as in the higher organisms. The nucleus is defined⁸ as "a cell body reproducing by mitosis" (p. 499). The fact that chromosomes are Feulgen-positive being a later discovery, identification of a

nucleus in yeast should be by an investigation of normal mitosis, preferably in Feulgen preparations. In the absence of such proof, differences of opinion between investigators in the same laboratory^{9,10,11} are only to be expected. Conclusions¹¹ drawn from the size of Feulgen-positive bodies in the so-called haploid, diploid and polyploid types would remain questionable so long as the identification of such structures as "nuclei" remain arbitrary.

To identify certain bodies in the yeast cell unequivocally as chromosomes, it should be shown that (1) they originate as a result of the resolution of the nucleus at the beginning of mitosis⁸ (p. 495); (2) they reproduce; (3) the daughter chromosomes are distributed equally to the mother cell and bud; and (4) it is these that reconstitute into nuclei at the end of mitosis.

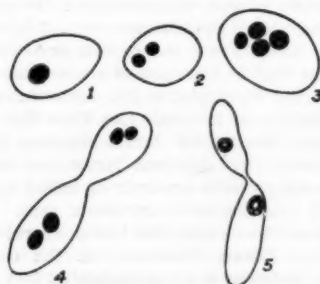


FIG. A (1-5): 1. 3.6 μ (Longest diameter). 2. 2.7 μ . 3. 3.6 μ 4. 9.0 μ (Mother cell and bud). 5. 9.0 μ (Mother cell and bud).

The photomicrographs presented are from smears fixed in OsO_4 vapour and stained by the Feulgen technique.¹² No Feulgen-positive structures are visible during the interphase. When a cell starts on its mitotic cycle, a small chromatin grain appears inside a clear unstained area (Fig. A, 1; Fig. B, 1). Though small at the beginning, it enlarges in size and gives rise by division (cf.^{4,5,6}) to the two chromosomes of early metaphase (Fig. A, 2; Fig. B, 2). The reproduction of the chromosomes at full metaphase is indicated by a constriction making each of them double. The daughter chromosomes begin to separate (Fig. A, 3; Fig. B, 3) into two groups of equal numbers and at late anaphase (Fig. A, 4; Fig. B, 4) mother cell and bud show two chromosomes each. The reconstituted nuclei of the telophase are illustrated in Fig. A, 5; Fig. B, 5.

R. glutinis has, therefore, two chromosomes. Is it a haploid or a diploid? It has been claimed recently^{11,13} that identification of diploids and auto-tetraploids by a study of their chromo-

some number should be confirmed by genetic analysis. This would appear rather strange to those familiar with the literature on the induction of polyploidy by chemical agencies.¹⁴ Historically, the discovery of polyploidy preceded⁸



FIG. 8

the analysis of the genetic behaviour of such types. The definition of a polyploid⁸ as "an organism with more than two sets of homologous chromosomes" (p. 499) is based purely on chromosome counts without any reference to its genetic behaviour. Identification of polyploids on genetic grounds^{11,13} require, on the other hand, cytological confirmation for their acceptance.

Genetic methods have their own limitations¹⁵ especially when the form is an octo- or 16-ploid. They cannot also help in elucidating whether an asporogenous yeast is a haploid or a diploid.

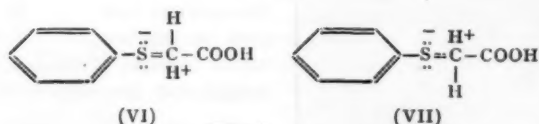
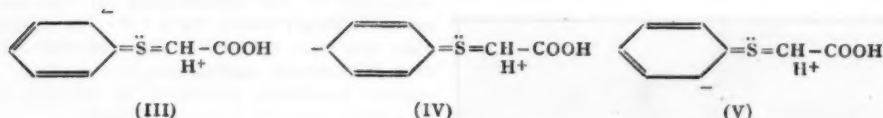
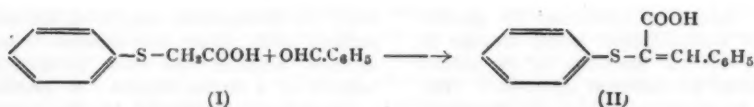
Once the chromosome number is known, a comparison with other sporogenous types would indicate whether the form in question is a haploid or a sterile diploid. *R. glutinis* shows a remarkable similarity in the number and behaviour of its chromosomes to the sporogenous brewery yeast, BY 1.4.5.6. The theoretically minimum number of chromosomes necessary for normal sporulation is only two. It appears justifiable, therefore, to conclude that *R. glutinis* may be a sterile diploid.

Cytogenetics Lab., M. K. SUBRAMANIAM.
Dept. of Biochem., T. R. THIAGARAJAN.
Indian Institute of Science,
Bangalore-3, December 7, 1953.

1. Lodder, J. and Kreger-van-Rij, *The Yeasts: A Taxonomic Study*, North-Holland Pub. Co., Amsterdam, 1952.
2. Subramaniam, M. K., *J. Ind. Inst. Sci.*, 1950, **32A**, 29.
3. Subramaniam, M. K. and Ranganathan, B., *Nature*, 1953, **172**, 628.
4. Subramaniam, M. K., *Proc. Natl. Inst. Sci. (India)*, 1946, **12**, 143.
5. Duraiswami, S. and Subramaniam, M. K., *Experientia*, 1951, **7**, 422.
6. Duraiswami, S., *Cellule*, 1953, **55**, 381.
7. Prahlada Rao, L. S. and Subramaniam, M. K., *Proc. Ind. Acad. Sci.*, 1953, **37B**, 72.
8. Darlington, C. D., *Recent Advances in Cytology*, J. & A. Churchill, London, 1932.
9. Lindegren, C. C., *The Yeast Cell: Its Genetics and Cytology*, Educational Pub. Inc., St. Louis, 1949.
10. Nagel, L., *Ann. Mo. Bot. Gdn.*, 1946, **33**, 249.
11. Mundkur, B. D., *Experientia*, 1953, **9**, 373.
12. Subramaniam, M. K., *Proc. Natl. Inst. Sci. (India)*, 1948, **14**, 315.
13. Lindegren, C. C. and Lindegren, G., *J. Gen. Microbiol.*, 1951, **5**, 885.
14. Krythe, J. M. and Wellensiek, S. J., *Bibl. Gen.*, 1942, **14**, 1.
15. Little, T. M., *Bot. Rev.*, 1945, **11**, 60.

THE POSSIBLE EXPANSION OF THE VALENCE SHELL OF SULPHUR IN HYPERCONJUGATED STRUCTURES

In the course of an investigation on the activating influence of a sulphur atom on the adjacent methylene group, we have found that arylthioglycolic acids condense with aromatic aldehydes on heating with catalytic amounts of piperidine and ammonium acetate in glacial acetic acid for 4-12 hours. For example, the condensation of phenylthioglycolic acid (I) with benzaldehyde gave α -phenylmercaptocinnamic acid (II). Its m.p. 142-143° C. agrees with that reported by Papa and Schwenk¹ (Found: C, 70.34; H, 4.60; C₁₅H₁₂O₂S requires C, 70.33; H, 4.69 per cent.).



The condensation, however, failed to occur when phenylthioglycollic acid was replaced either by alkylthioglycollic acids or by phenoxyacetic acid. Phenylthioglycollic acid and phenoxyacetic acid were recently condensed with benzaldehyde by Papa and Schwenk¹ under the conditions of the Perkin reaction. The condensation was effected at 105-115° C. in 48 hours. They obtained the pure condensation products in 22 per cent and 34 per cent. yields from phenoxyacetic acid and phenylthioglycollic acid respectively. The smaller yield with phenoxyacetic acid in the Perkin reaction and the non-reactivity of phenoxyacetic acid with benzaldehyde under the conditions of the present modified procedure indicate that the -CH₂- group in phenoxyacetic acid is less reactive than that in phenylthioglycollic acid. If the activation of the -CH₂- group is partly due to the carboxyl group and partly due to the inductive electron attraction of the oxygen or sulphur atom, C₆H₅O.CH₂.COOH should be expected to condense more readily than C₆H₅S.CH₂.COOH since the inductive effect of the oxygen atom is greater than that of the sulphur atom. But the order of reactivity has been found to be reversed. Hence it seems to be highly probable that hyperconjugated structures of the type III, IV and V, made possible by the expansion of the valence shell of the sulphur atom, make significant contributions to the resting state of phenylthioglycollic acid. Such expansion of the valence shell is not possible in the case of oxy-

gen atom. Structures such as VI and VII, which are analogous to those suggested for mercaptals by Rothstein,² may also be proposed. But then alkylthioglycollic acids should be as reactive as phenylthioglycollic acid. The fact that they are less reactive than phenylthioglycollic acid makes

the contributions of structures VI and VII less significant.

Dept. of Chemistry,
Annamalai University,
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September 29, 1953.

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R. VARADACHARI.

1. Papa, D. and Schwenk, E., *J. Amer. Chem. Soc.*, 1947, **69**, 3022.
2. Rothstein, E., *J. Chem. Soc.*, 1940, 1550.

VARIETAL RESISTANCE OF WHEAT TO LOOSE SMUT (*USTILAGO TRITICI*)

TWENTY-TWO promising varieties of wheat were tested for their resistance to loose smut during 1951-52 and 1952-53 at Government Research Farm, Kanpur. The varieties were inoculated with spore suspension (1 gm. smut powder in 1 litre water) during their flowering stage by "vacuum method" in the late afternoon. The seeds obtained from the inoculated heads were sown in rows of 20' on two dates with an interval of 20 days. The smut percentage was calculated by counting the number of healthy and smutted heads. The wheat varieties on the basis of average smut infection may be grouped as follows:

- Resistant (Below 1 per cent. infection)—Bansi Pali 808, Bansi CP., N.P.710.
Moderately susceptible (Below 10 per cent. infection)—Pb9D, N.P.165, Pb228.
Susceptible (Above 10 per cent. infection)—Pb8A, Padawa I, N.P.720, N.P.125, Pb518, A.O.68, C46, N.P.773, Pb591, N.P.52, Padawa II, N.P.775, Pb281, C13, N.P.4, N.P.12.

Late sowing exhibited greater smut infection in each of the varieties as compared to normal sowing. Most of the susceptible varieties showed from 40 to 76 per cent. infection in late sowing and from 15 to 36 per cent. in normal sowing during 1951-52.

We are grateful to Dr. A. K. Mitra for supplying the wheat varieties.

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Pathologist to Govt., U.P.,

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PREPARATION OF WHOLE MOUNTS OF LARVAE OF SUGARCANE MOTH BORERS TO STUDY THEIR TRACHEAL SYSTEM

VERY little information is available regarding the technique for preparing whole mounts of insects in order to study their tracheal system. The only work of some importance on the subject seems to be that of Roonwal,¹ who mounted white-fly nymphs in glycerine and in de Faure's chloral hydrate medium to demonstrate tracheae. The tracheae remained clear and silvery for some hours, after which the mounting medium penetrated the tracheal tubes. The present note describes a new technique by means of which the tracheal system of the larvae of sugarcane moth borers can be made very clear and studied in permanent whole mounts which can be projected on the screen.

The technique consists in killing the experimental specimens by immersion in strong alcohol followed by fixing in 70 per cent. alcohol for a week (as a result of which the two lateral tracheal trunks with their branches become hardened and fixed) and their subsequent immersion in a strong solution of KOH for about 24 hours. This is followed by a thorough washing with water for 8-12 hours, after which the specimens are treated with diaphanol for bleaching and softening the chitin. They are again washed with water and gradually pressed in between two glass slides one by one. As a result of this manipulation, the internal organs of the larvae are eliminated, only the lateral tracheal trunks with their branches attached to the body wall being left behind. The specimens fixed in units of two slides as explained above and fastened together at their two ends by means of clips, are placed in a staining jar containing methylated spirits for about 20 minutes. They now adopt the required shape and the slides are carefully separated to transfer the specimens to a watch glass containing fresh alcohol. They are then washed in several changes of fresh alcohol, and brushed carefully with a fine camel hair brush to remove any debris clinging to their surface. They are thereafter stained with eosin in 90 per cent. alcohol and upgraded after which they are kept immersed in turpentine oil to which

has been added phenol (heated until fluid) in the ratio of 3 phenol to 5 turpentine. After 24 hours they are taken out and cleared first in pure turpentine oil to get rid of the last traces of phenol and then in cedarwood oil. Finally, the treated specimens are mounted in canada balsam. Fig. 1 is a photographic reproduction

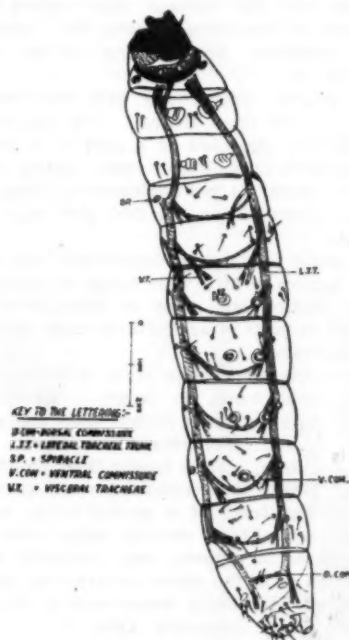


FIG. 1

of a camera lucida drawing from a permanent slide of sugarcane stem borer *Argyria sticticrasis*, prepared by the technique described above and clearly shows the position of the spiracles and the two lateral tracheal trunks with their main branches duly labelled. Further details of this work will be published elsewhere.

The author is deeply indebted to the Government of Bihar and the Indian Central Sugarcane Committee for financing the scheme of research of which the present work forms a part. He is also grateful to Shri K. L. Khanna for his kind interest and encouragement.

Central Sugarcane Res. Stn., V. D. PURI.
Pusa, Bihar, September 18, 1953.

1. Roonwal, M. L., *Quart. Jour. Micros. Sci.*, 1935, 77, 605.

**TANYMECUS INDICUS FST., A NEW
CURCULIONID PEST OF PADDY WITH
SUGGESTIONS FOR ITS CONTROL**

IN July 1953, severe and extensive damage to *Aman* paddy seedlings was reported by the cultivators of Amjhora Union, in the District of 24 Parganas, West Bengal. The beetle responsible for the damage was subsequently identified as *Tanymecus indicus* Fst., belonging to the subfamily, Brachyderinae, of the family Curculionidae.

The species *indicus* was first described by Faust¹ in 1894 from Bengal. The species has hitherto been recorded as a pest of a number of important agricultural crops among which however, paddy is not included.^{2,3} Hence the authors record it for the first time as a pest of paddy.

The genus *Tanymecus* comprises a large number of species with a wide range of geographical distribution and many of them have been recorded as pests of agricultural crops of economic importance.

The insects are greyish black in colour, measuring about 6 mm. in length. Eyes large. Rostrum with a distinct central ridge and a very shallow curved indentation at the apex. Prothorax leathery, a little longer than broad with rounded sides, not constricted near apex and with a faint trace of a central ridge on the anterior half. Elytra densely scaled with lines of punctures in grooves, very gradually tapering behind with the apices divergently pointed. Legs black with fairly dense scaling, the tibiae not denticulate internally (Fig. 1).



FIG. 1 *Tanymecus indicus* Fst.

The insect, popularly known in Northern India as "Godela", has long established itself as a serious pest of newly germinating rabi crops, particularly wheat, gram and pea, and less

frequently barley and poppy. The paddy seedlings were affected in the seed-beds within the first 15-20 days of development. The affected plants dried up rapidly without giving any indication of external injury by insects. But when pulled out of the soil the underground portions of the stems, lying just above the roots, were found to be badly damaged due to the nibbling of these insects, resulting in partial or complete detachment of the stems from the roots (Fig. 2).

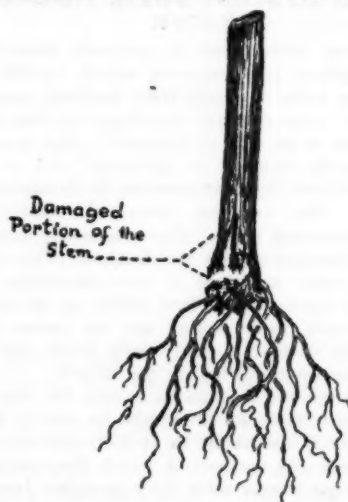


FIG. 2 Damage caused to paddy plants by *T. indicus*.

Besides the adults, the larvae of this insect found in the soil also played a great part in the ravage.

For the control of these insects, the authors suggested the flooding of the seed-beds with a view to compel them to come above the level of water, when it would be easy to apply insecticides against them. The measure yielded immediate results and the attack subsided within a week.

The authors take pleasure in expressing their gratitude to the Commonwealth Institute of Entomology, London, for kindly identifying the insect, and to Mr. B. K. Bera for sketching the figures.

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Tollygunge,
Calcutta, October 1953.

1. Faust, J., *Ann. Mus. Civ. Genova*, 1894, **34**, 177, note (1895).
2. Marshall, G. A. K., *The Fauna of British India, Curculionidae*, Pt. I, 1916, 99.
3. *Ind. Mus. Notes*, III, 1893-94, 12 and 118; IV, 1899, 123 and 188.

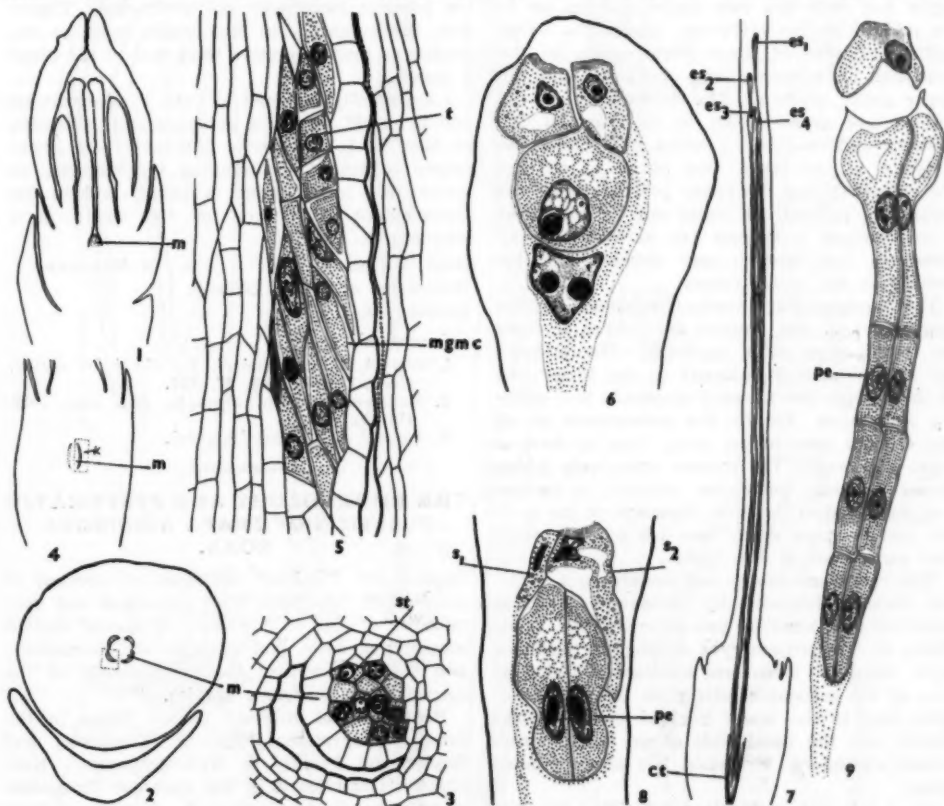
FEMALE GAMETOPHYTE, ENDO-SPERM AND EMBRYO OF *LYSIANA EXOCARPI* (BEHR.) VAN TIEGHEM

ALTHOUGH considerable embryological work has been done on the Loranthoideae, *Lysiana exocarpi* has not yet received any attention. My observations, based on material of this plant obtained from Australia, have shown some features of interest which are worthy of mention.

In a young bud a mound-shaped projection, the mamelon, arises from the base of the ovarian cavity (Fig. 1). In a transverse section it

appears 4-lobed and is fused with the ovarian wall between the lobes making the ovary 4-chambered (Fig. 2). During further growth the apex of the mamelon reaches up to the base of the style. Though ovules in the usual sense are absent, each lobe of the mamelon may be said to represent a greatly reduced ovule.

In each lobe of the mamelon 3-4 hypodermal layers differentiate into archesporial cells. The latter elongate diagonally, become spindle-shaped and directly function as megaspore mother cells (Fig. 5). Linear tetrads of mega-



FIGS. 1-9.

Fig. 1. L.S. young bud showing mamelon (diagrammatic). Fig. 2. T.S. ovary showing the 4 lobes of the mamelon, $\times 7$. Fig. 3. Hypodermal archesporium in a lobe of the mamelon enlarged from Fig. 2, $\times 298$. Fig. 4. L.S. ovary showing the lobes of the mamelon, $\times 5$. Fig. 5. Enlarged view of portion marked A in Fig. 4 to show mother cells and tetrads, $\times 298$. Fig. 6. Tip of mature embryo sac showing egg apparatus and secondary nucleus, $\times 288$. Fig. 7. Outline figure to indicate the height to which the embryo sacs grow in the style (diagrammatic). Fig. 8. First division of zygote, $\times 288$. Fig. 9. Biseriate pro-embryo, $\times 288$.

(*ct*—collenchymatous tube; *es*—embryo sac; *mgmc*—megaspore mother cells; *pe*—pro-embryo; *s*—synergid; *st*—sporogenous tissue; *t*—tetrad).

spores are formed. Many of the mother cells, particularly those situated towards the central axis of the mamelon, become arrested and degenerate. At this stage a U-shaped collenchymatous tube becomes distinguishable below the mamelon.

Usually the basal megaspore of the tetrad, i.e., the one situated towards the base of the ovary, functions but the two middle ones may also develop up to the 2-nucleate stage. The 4-nucleate embryo sac elongates considerably and destroys the tissue lying in its way. The upper end with the two nuclei reaches up to the middle of the 45-50 mm. long style. One further division of these nuclei leads to the formation of a normal egg apparatus and the upper polar nucleus. The lower end of the embryo sac grows down to the base of the collenchymatous tube. I could not follow the divisions of the lower two nuclei or observe the antipodals but the lower polar nucleus was invariably present. It could not be confirmed if any caecum is formed (as in *Macrosolen*).² Three to five embryo sacs develop simultaneously in the stylar tissue.

The lower polar nucleus migrates to the upper part of the embryo sac where it fuses with the upper polar nucleus. The primary endosperm nucleus descends to the lower end of the embryo sac where it gives rise to a cellular endosperm. Finally the endosperms of all the embryo sacs in an ovary fuse to form a composite mass. The mature endosperm which shows 5-6 deep peripheral furrows, is narrow and truncated at the base, broadens in the middle and narrows again into 5-6 conical tooth-like structures at the apex.

The zygote elongates and undergoes a vertical division followed by transverse divisions resulting in a biseriate pro-embryo (Figs. 8, 9). Three to five pro-embryos develop in the same style. Repeated transverse divisions and elongation of the suspensor cells push the embryonal cells first to the lower part of the style and finally into the basal ends of the embryo sacs where endosperm formation has already taken place.

As a rule only a single pro-embryo develops further and the embryonal tier divides repeatedly giving rise to a globular mass of cells. The two cotyledons are somewhat unequal and fuse along their inner margins. The radicular end shows a number of lateral processes. The cotyledons are situated in the middle of the endosperm but the hypo-cotyledonary region and the radicular end project above it. The ovoid fruit is a pseudoberry with a massive endosperm enclosing a single naked embryo.

The outer wall of the fruit develops the characteristic viscid layer which helps in dispersal.

The absence of the placenta and the ovules, the elongation of the embryo sac into the style and the formation of the long biseriate pro-embryo are unique features of the Loranthaceae. The conical mamelon of *Amyema*¹ and *Helicanthes*³ is devoid of any basal lobes but in *Macrosolen*,^{1,2} *Lepeostegeres*¹ and *Elytranthe*,¹ there are three basal lobes completely free from the ovary wall. In *Lysiana* alone the mamelon is 4-lobed and the part in between the lobes is fused with the ovary wall. Therefore the condition in this genus may be regarded as more primitive than that in the other 5 genera.

I am greatly indebted to Prof. P. Maheshwari and Dr. B. M. Johri for guidance and criticisms, to Mrs. E. L. Robertson (Adelaide) for generously collecting and sending the material on which this investigation is based, and to the Government of Mysore for the award of a scholarship.

Dept. of Botany,
University of Delhi, Delhi-8,
October 12, 1953.

R. NARAYANA.

1. Schaeppi, H. and Steindl, F., *Vrtljschr. naturf. Gesell. Zürich*, 1942, **87**, 301.
2. Maheshwari, P. and Singh, B., *Bot. Gaz.*, 1952, **114**, 20.
3. Agrawal, J. S., 1954 (In press).

THE EMBRYOLOGY AND SYSTEMATIC POSITION OF *TRAPA BISPINOSA* ROXB.

GIBELLI and FERRERO³ published an account of morphology, anatomy, fruit formation and germination of seed in *T. natans*; Ishikawa⁵ studied megasporogenesis and embryo sac formation; and Tison⁷ described the development of the suspensor in the same species.

Bentham and Hooker¹ placed *Trapa* in the family Onagraceae, Pulle⁶ in Trapaceae; and Engler and Prantl² in Hydrocaryaceae. Hutchinson⁴ includes it in the suborder Trapoideae as an appendix to Onagraceae. In view of these conflicting opinions it was considered worthwhile to investigate the Indian species, *T. bispinosa*, to find out how far embryological data confirm or reject the above assignment.

The wall of the microsporangium comprises the persistent epidermis, fibrous endothecium, 2-3 middle layers and the multinucleate glandular tapetum which is often 2-layered at certain places here and there. The inner wall of the tapetal cells shows some cutinization. The

microspore mother-cells undergo simultaneous reduction divisions and form decussate and tetrahedral tetrads. The mature pollen grains are pyramidal with 3 meridional crests and are shed at the 2-celled stage.

The pendulous ovule is anatropous, bitegmic and crassinucellate. The massive nucellar beak protrudes beyond the integuments (Fig. 1). A

1- or 2-celled archesporium differentiates in the young nucellus (Fig. 2). The megaspores are arranged in a linear fashion (Fig. 3) but occasionally 1-shaped or isobilateral tetrads are also formed. The chalazal megaspore functions and leads to the formation of 2- and 4-nucleate embryo sacs (Figs. 4-6).

The organised embryo sac is very slender.

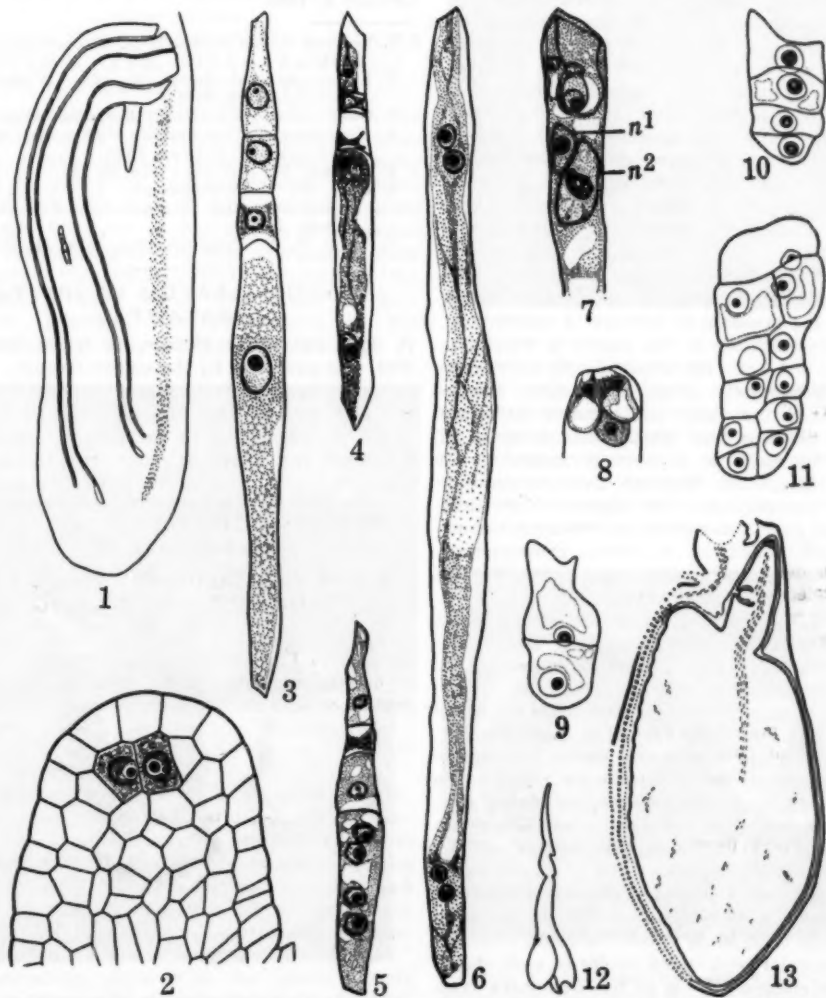


FIG. 1. L.s. ovule at tetrad stage, $\times 55$. FIG. 2. Hypodermal archesporial cells, $\times 612$. FIG. 3. Linear tetrad of megaspores, $\times 612$. FIGS. 4-6. 2- and 4-nucleate embryo sacs, $\times 355$. FIGS. 7-8. Upper ends of mature embryo sacs; for explanation of n^1 and n^2 see text, $\times 355$. FIGS. 9-11. Earlier stages of embryo development, $\times 504$. FIG. 12. Embryo with massive suspensor, $\times 14$. FIG. 13. L.s. mature seed showing one large and one very small cotyledon, $\times 6$.

The micropylar end, which is broader and slightly curved, contains a normal egg apparatus (Fig. 8). Fig. 7 also shows two large nuclei of unequal size situated below the egg (n^1 , n^2). They may represent the two polar. Or, the larger nucleus (n^2) may have arisen by the fusion of the antipodal nuclei and the smaller (n^1) by the fusion of the polar nuclei. Still another possibility is that the larger may be the fusion product of all the four nuclei at the chalazal end. No antipodals were observed.

Ishikawa⁵ reports that in *T. natans* the antipodal nuclei may either degenerate or fuse to form a large hypertrophied nucleus. I invariably observed a hypertrophied nucleus at the basal end of the fertilized embryo sac but am unable to make a definite statement about its origin. None of the embryo sacs showed any trace of endosperm. Tison⁷ also failed to find an endosperm in *T. natans*. It will require further work before giving a complete picture of the organization of the mature embryo sac and the presence or absence of endosperm.

The first division of the zygote is transverse (Fig. 9) and both the terminal and basal cells divide transversely (Fig. 10). After the 4-celled stage the basal cell remains undivided while transverse and longitudinal divisions of other cells result in a biseriate proembryo of 6 tiers (Fig. 11). Further divisions continue but are less regular. The suspensor cells elongate and push the embryo downwards, becoming much coiled as in many gymnosperms. Later, a suspensor collar, open on one side, envelops the embryo (Fig. 12).

The embryo has one large and massive cotyledon; the other, which arises very late, is extremely reduced and is seen as a small protuberance near the stem tip (Fig. 13).

Trapa has a bilocular, semi-inferior ovary with a single pendulous ovule in each chamber. The embryo sac is probably of the monosporic 8-nucleate type and an endosperm seems to be lacking. The embryo shows a characteristic coiled suspensor and one of the cotyledons becomes arrested. It bears little resemblance to the embryo of the Onagraceae even in earlier stages of development. The fruit is a one-seeded drupe. Evidently it is incorrect to assign the genus to the family Onagraceae where the ovary is usually tetralocular with many ovules in each chamber, the embryo sac is of the Oenothera type, the embryo conforms to the Onagrad type, the suspensor is poorly developed, both the cotyledons are similar and well developed, and the fruit is a loculicidal capsule.

The erection of a separate family Trapaceae (Pulle⁶) or Hydrocaryaceae (Engler and

Prantl²) is, therefore, fully justified on embryological grounds.

It gives me great pleasure to express my gratitude to Dr. B. M. Johri and Prof. P. Maheshwari who suggested the problem and guided the work.

Dept. of Botany,
University of Delhi,
October 8, 1953.

MANASI GHOSH.

1. Bentham, G. and Hooker, J. D., *Genera Plantarum*, 1883.
2. Engler, A. and Prantl, K., *Die Natürlichen Pflanzenfamilien*, 1924.
3. Gibelli, G. and Ferrero, F., *Malpighia*, 1895, 9, 3.
4. Hutchinson, J., *The Families of Flowering Plants*, I. Dicotyledons, London, 1926.
5. Ishikawa, M., *Ann. Bot.*, 1918, 32, 279.
6. Pulle, A., *Compendium van de Terminologie, Nomenclatuur en Systematiek der Zaaipflanzen*, Utrecht, 1938.
7. Tison, M. A., *Revue Gén. Bot.*, 1919, 31, 219.

CORPUS ALLATUM IN *IPHITA* LIMBATA STAL.

A NOTE on corpus allatum of *Iphita limbata* Stal. was published by the author recently. With reference to the secretory product mentioned in the text, he has been able to obtain a photograph of the section of the corpus allatum of a nymph just about to moult into the imago,



FIG. 1. Photograph of section of corpus allatum from the nymph of *Iphita limbata* Stal., about to moult into the imago. Fixation in dichromate-formal-acetic; stain iron hæmatoxylin. The structure lying near the corpus allatum is the aorta.

where also the secretion is seen as a granular mass stainable blue by hæmatoxylin after

fixation in dichromate-formal-acetic. This is another evidence for the accumulation of secretion in the corpus allatum.

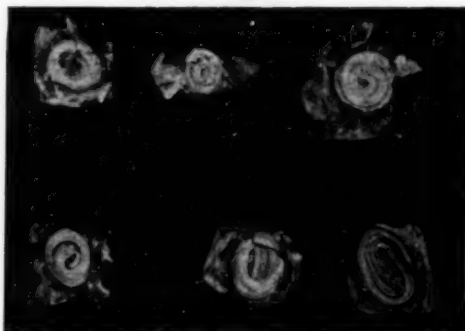
Zoology Laboratory,
University College,
Trivandrum, Camp: London,
October 19, 1953.

K. K. NAYAR.

1. Nayar, K. K., *Curr. Sci.*, 1953, 22, 241.

ON THE VIVIPAROUS HABIT OF THE FRESH-WATER SNAKE, *ENHYDRIS* *DUSSUMIERI* (SMITH)

WHILE snakes are mostly oviparous, there are some known to be viviparous, especially members of the subfamily Homalopsinae.⁴ Adaptations to viviparity and development in these lower amniotes are of considerable scientific interest. Weekes^{5,6} in two species of *Denisonia* and Kasturirangan^{1,2} in two sea-snakes, have described the structure and formation of the placenta in those forms. The author has previously described the placentation in the brackishwater snake—*Cerberus rhynchops*.⁷



(i) *Enhydris dussumieri*—embryos in stages of development.

Enhydris dussumieri is a viviparous fresh-water snake commonly found in North Travancore and locally known by various names in Malayalam as *Thadikkippotten*, *Polavan*, etc. The snake is quite harmless, sluggish in habits and easily survives in captivity. A detailed study on the development and adaptations to viviparity in this snake is being carried out.

Observations show that the snake breeds early in June with the onset of the south-west monsoon, the period of gestation lasting more than 5 months. Early eggs in the uterus are elliptical in shape and, as usual in reptiles, megalecithal, measuring 20 mm. \times 15 mm. The

blastodisc lies over a small area of the yolk mass. There is no egg shell as such, but a very thin shell membrane is present. The number of eggs was found to vary in different specimens. A large number of eggs, however, begin development in the two uteri, and probably



(ii) Embryos of two later stages displayed showing body stalk, yolk sac and allantois.

during their development some atrophy, and the number is reduced towards the final stages of pregnancy, the yolk in the atrophied eggs being absorbed by the developing embryos. The snake is all the same prolific, and in one instance 25 living embryos (Figs. 1-3) were given by birth by a female.

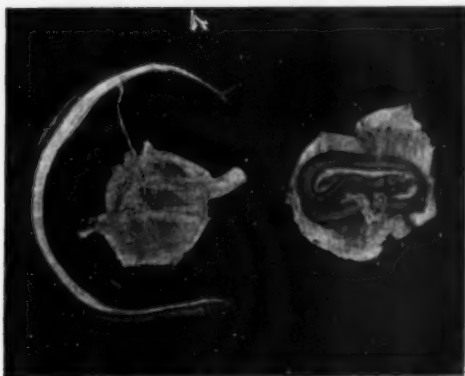


FIG. 3. 'Advanced embryo of length 9 inches: with the egg yolk fully absorbed and placental features completely established.'

The egg yolk is fully consumed when the embryo measures about 7" in length and this roughly indicates 4 months gestation. By now

the highly vascular allantois has grown round the embryo and a chorio-allantoic placenta is fully established. This species of snake is thus truly viviparous. Gestation is further continued for a month, the full grown embryo reaching a length of 9". At birth, the allantois with its umbilical vessels is discarded.

Further work is in progress.

Dept. of Zoology, K. N. PARAMESWARAN.
Sanatana Dharma College,
Alleppey, November 12, 1953.

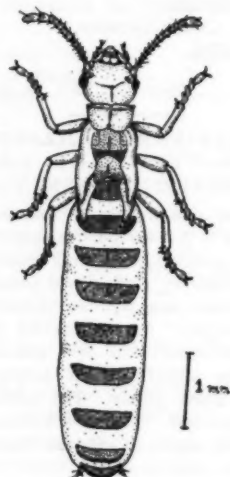
1. Kasturi Rangan, L. R., *Proc. Ind. Acad. Sci.*, 1951, **34B**, 1.
2. —, *Journ. Zool. Soc. India*, 1951, **3**, No. 2, 227.
3. Marshall, F. H. A., *Physiology of Reproduction*, 1952, **2**, Macmillan Co., London.
4. Smith, M. A., *Fauna of British India. Reptilia and Amphibia*, 1943, **3**, Taylor & Francis, London.
5. Weekes, H. C., *Proc. Linn. Soc., N. S. W.*, 1933, **58**, 270.
6. —, *Proc. Zool. Soc.*, 1935, **2**, 625.
7. Parameswaran, K. N., 1953 (under publication).

ON NEOTEINIC TERMITES FROM A COLONY OF *MICROCEROTERMES* *BEESONI* SNYDER (ISOPTERA, TERMITIDAE)

NEOTEINIC termites have been reported only once in India from Bombay from a colony of *Microcerotermes Heimi* Wasm.¹ There were 13 queens (apterous or brachypterous unknown) and no males. A small carton nest of *M. beesoni* Snyder was recovered from Delhi recently from the soil round the base of the stem of a pear tree. This contained largely the workers, nymphs, a few soldiers and in addition 45 brachypterous neoteinic females, but no males. The adult macropterous caste was also unrepresented. The neoteinic forms were distributed in nearly 20 chambers most of which also contained egg-masses. These forms were obviously reproducing as was proved by the fact that they laid eggs even when kept singly in glass tubes. Absence of any male with them suggests the occurrence of parthenogenesis, a view previously expressed in respect of some termites.^{2,3}

All brachypterous forms were morphologically alike except for slight differences in the size of abdomen in some owing to physogastry. Each possessed two pairs of short wing-pads arising from the meso- and metanotum and extending up to the second and third abdominal tergite (Fig. 1). Both pairs were equal and similar in all specimens, being 0.94 mm. in

majority, smallest being 0.73 mm. in one specimen and longest 1.6 mm. in two specimens. The brachypterous forms closely resemble the imago⁴ in most external characters, e.g., eyes,



ocelli, fontanelle and pronotum but differ in having (i) a smaller body (Table I), and (ii) 13 segments in antennae instead of 14.

TABLE I

	Brachypterous form		Winged adult (measurements after Snyder in mm.)
	Range (in mm.)	Majority (in mm.)	
Length of body (Non-physogastric)	3.94-4.34	4.00	5.0-6.0
Length of head	.95-1.03	1.03	1.05-1.1
Width of head	.73-.78	.75	0.8-0.85
Length of pronotum	.35-.39	.37	0.4
Width of pronotum	.60-.66	.62	0.65-0.7
Length of hind tibia	.64-.68	.68	0.8

Two individuals were recovered from the colony which seemed to be the nymphs of the brachypterous forms. They were both smaller in size and differed from the latter in some features: less pigmented cuticle, poorly developed compound eyes, ocelli absent, anterior margin of the pronotum much more elevated. One of them, slightly larger than the other, had developed two pairs of short wing rudiments as postero-lateral buds from meso- and metanotum while the other was still apterous. They were both males externally though gonads were not formed.

Besides these, the nymphs mainly consisted of those which had developed two pairs of longer wing-pads. In body measurements they were much larger than the brachypterous forms, and were rather nearer to the imago form. Their origin is presumed to be due to a possibly died out macropterous caste functioning previously.

It is concluded that this small colony was headed entirely by the brachypterous neoteinic forms, at least at the time of the collection, and then, in all probability, were reproducing parthenogenetically.

My thanks are due to Dr. M. L. Roonwal for kindly identifying this termite, and to Dr. M. L. Bhatia for his kind guidance in the work.

Dept. of Zoology, H. S. VISHNOI
University of Delhi, Delhi-8,
October 24, 1953.

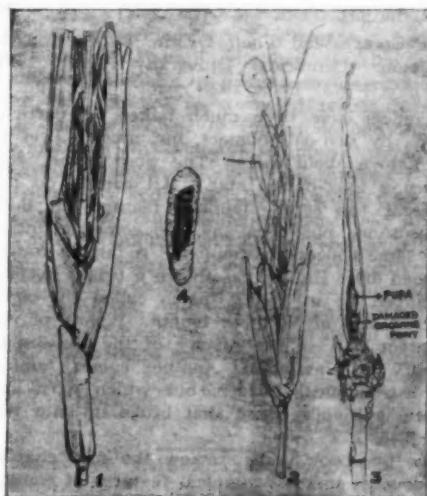
1. Holmgren, N., *Journ. Bombay Nat. Hist. Soc.*, 1912, 21, No. 3, 790.
2. Light, S. F., *Univ. Calif. Publ. Zool.*, 1944, 43, 405.
3. Grasse, P. P. and Noirot, C. H., *C. R. Acad. Sci.*, 1946, 223, 560.
4. Snyder, T. E., *Proc. U.S. Nat. Mus.*, 1933, 62, (16), 12.

'GALLS' ON SACCHARUM SPONTANEUM L.

THE occurrence of 'galls' is a common feature in grasses and are known to be caused by gall midges (Cecidomyiidae). Typical 'gall' formations have been noticed in the grass *Cynodon dactylon* (Himalia)¹ causing a malformation of the shape of a miniature pineapple. 'Galls' occurring on the stem, node and internode as also terminally due to the injury of the growing point have been reported as a fairly common feature in commercial sugarcane varieties in Hawaii and Java.²

During the course of the exploration work in connection with the collection of forms of *S. spontaneum*, the Botanist of this Institute collected specimens ('galls') from one of the *S. spontaneum* forms from Nainital District in Uttar Pradesh and another from Assam. Malformations or monstrous growths resembling 'galls' were noticed. These 'galls' were in the form of 'bunchy tops' (Plate) and on examination, it was found that the growing point was damaged and the several axillary buds at the condensed portion of the stalk proliferate. Very often the axillary buds were noticed to divide giving rise to 2 or 3 axillary shoots at each node. The laminae and the leaf-sheaths cease to elongate and the sheaths grow in width, with the result that the axillary shoots often outgrow the leaves. The composite leaf spindle thus assumes a characteristic lanceolate shape, the widened sheaths and the growing buds together forming the 'bunchy top'.

On cutting open these 'bunchy tops', it was seen that the growing point was damaged and



Galls from *Saccharum spontaneum*

1 and 2. Galls—As collected from nature. 3. A Gall dissected to show the damaged growing point, with pupa *in situ*. 4. A pupa.

in most cases immediately above it was found a 'Dipteran' pupa. This is evidently the causal agent. The search for larvae and adults from the collected specimens, however, proved futile. In the absence of these stages of the insect, it was not possible to determine the genus. But Dr. Sabrosky has now given his opinion that the pupae "probably belong to a new genus near *Anthrocophaga*; *Siphilus*; *Homalura*" in the family *Chloropidae* (Diptera).

This is presumably the first record of any *Saccharum* species being attacked by this insect. The appearance of such insect 'galls' in the genus *Saccharum* has also probably been noticed for the first time. Attempts are being made to collect the adults with a view to studying its life-history as also to record the full description and to determine the genus and species.

My thanks are due to Shri R. R. Panje for kindly collecting these specimens for me and to Shri N. L. Dutt for kind encouragement.

Sugarcane Breeding Inst., G. NARASIMHA RAO,
Post Lawley Road,
Coimbatore, November 4, 1953.

1. "Second hundred notes on Indian Insects," *Agricultural Research Institute, Pusa. Bull.*, No. 89, 1919, 53.
2. Martin, J. P., *Proc. Ent. Soc. Sng. Tech.*, 1932.

REVIEWS

The Comets and Their Origin. By R. A. Lyttleton. (Cambridge University Press), 1953. Pp. x + 173. Price 25 sh. net.

Comets have been much talked of, particularly, by non-astronomers, but much is yet to be known about them. The word 'comet' signifies a long-haired star. All comets do not present the same standard features in their appearance nor does any one comet maintain the same appearance for long. A famous comet, named after Halley, has shown a bright nucleus wrapped up in a hazy patch called the coma and a tail of variable length. It has played a great part in the history of the Newtonian theory of gravitation. Another comet, famous in astronomical history, but which exists no more is Biela's comet that broke up into two in 1846.

In the book under review the first chapter is devoted to the dynamical features of comets, with periods from anything like 3 years to 40,000 years and with a very wide range of inclinations and eccentricities. In the second chapter the various baffling features of their physical properties are vividly described with diagrams and photographs, with a reference to their small masses, the large and variable sizes, the spectrum, the tails and the meteor showers. The next two chapters contain the author's original contributions to the subject of the origin and formation of comets and the formation of tails. In the last chapter convincing arguments are given showing how the earlier theories of Proctor, Chamberlin, Crommelin and others failed to account for the known facts regarding the comets. The accretion hypothesis which has been successfully used in the theory of stellar evolution offers, according to Lyttleton, an explanation of many of the strange properties of the comets. The latter are formed in the wake of the sun as it slowly moves in an interstellar cloud. Thus a comet "consists of very large numbers of widely separated particles". The author shows how internal collisions may produce lighter particles ultimately responsible for the tails. It is an attractive theory and an impressive volume of evidence is given in its support. If the theory is on sound lines it should be possible to construct more convincing mathematical proofs in the light of its main arguments. The book will be read with great interest by all those who are interested in comets and in the various challenging problems about them. V. V. NARLIKAR.

Kernel Functions and Elliptic Differential Equations in Mathematical Physics. By S. Bergmann and M. Schiffer. (Academic Press, N.Y.), 1953. Pp. xiv + 432. Price 64 sh. net.

Today, applied mathematics is being recognized as a science in its own right and not as a mere watered down version of pure mathematics. The tendency has therefore been to foster the discipline of mechanics as a deductive mathematical science in the true classical tradition. It is to this end that the work of Bergmann and Schiffer on elliptic differential equations is devoted.

The theory of boundary value problems in partial differential equations occupies a central place in every branch of applied mathematics and theoretical physics. Treatises have been written on this subject by many authors, with varying degrees of emphasis on physical applications, but Bergmann and Schiffer have in addition attempted to 'rationalise' the theory of elliptic differential equations from a 'unifying point of view'.

The book comprises two parts, the first consisting of a survey, in four chapters, of boundary value problems from important branches of mathematical physics, heat conduction, fluid dynamics, electro- and magneto-statistics and elasticity. The chapter on fluid dynamics deserves special mention, for it summarises with clarity and precision many of the advanced ideas of fluid dynamics which are normally to be found only in treatises devoted solely to hydrodynamics. The authors show first with the aid of physical examples that all solutions of the elliptic differential equations occurring in physics can be expressed in terms of certain fundamental solutions or 'Kernel functions' whose main properties are: they depend on two argument points in the domain, they are symmetric in both and are functions of each separately. Examples of such solutions are the Green's, Neumann's and Robin's—G, N and R—functions. Though G, N and R functions possess singular points in the domain of definition, combinations of them can be found which are regular throughout the whole domain. Part II deals in a systematic manner with the properties of these fundamental solutions.

One general remark which may be made about the book is that it assumes a degree of familiarity with the methods of mathematical analysis not easily found in students of applied mathematics. However, to meet the needs of

such readers, the authors have nourished their rigorous analysis with physical applications in the first part of their book.

Two features of the book are to be specially noted: (1) the notation used in the first four chapters dealing with different branches of physics is consistent and emphasises the essential unity of the mathematical methods developed, (2) reference to books and original papers are given at the end of each section in addition to the comprehensive bibliography at the end of the book.

There is no doubt that the book will stimulate the interest of pure mathematicians in physical applications and create in the physicist a 'taste' for mathematical rigour.

ALLADI RAMAKRISHNAN.

Electrodeposition Research. (NBC Circular 529, issued May 22, 1953.) (Available from Supdt. of Documents, U.S. Govt. Printing Office, Washington 25, D.C.) Price \$1.50.

The publication is a collection of twenty-two papers presented at the Symposium on Electrodeposition Research held by the National Bureau of Standards organized during the Bureau Semi-Centennial in 1951.

G. E. Gardam in his paper, 'Research on Electrodeposition in Great Britain', dwells on the distribution of research effort among the various institutions, producers of plant and material and consumers, and indicates a few typical recent research projects investigated. These studies relate to fundamental causes of porosity of nickel-coating of steel, production of thick nickel deposits, adhesion of electrodeposits of aluminium, electrodeposition, and alloy deposition of tin and nickel. 'Electroplating in France' by Jean Salauze indicates the important lines of research relating to the development of chromium plating and study of nature of chromium deposits and fundamental investigations relating to electropolishing and anodising of aluminium. 'Electroplating Research in Germany, Belgium and Holland' by Baeyens reveals that the subjects of study in Germany are mainly hard chromium plating, anodising, bright nickel plating and electrolytic polishing. In Belgium and Holland, recent objects of study have been conversion coating on zinc and cadmium and the metallising of non-conductors. Development and utilisation of electrodeless nickel-plating is another investigation of interest. Several papers are devoted to research carried on in different research organisations in U.S.A. such as the National Bureau of Standards, Battele Memorial Institute, Bureau of Mines and the Armour Research

Foundation. Progress of research in laboratories of some important industries like the Westinghouse Electric Corporation, United Chromium Inc., Enthone Inc., Sylvania Electric Products, have been presented in a few papers. There are some outstanding individual contributions on different subjects of interest to the electroplater, viz., studies in corrosion resistance of electrodeposits, effects of impurities and their determination in plating solutions, physical properties of electrodeposited nickel, porosity of electrodeposits and disposal of cyanide wastes. It is observed from the deliberations that subjects like chromium plating, electropolishing of metals and alloys, periodic reverse current plating, plating on aluminium and titanium and alloy deposition are receiving considerable attention in the various research centres.

The publication is a valuable contribution facilitating easy correlation of information and results of research.

J. BALACHANDRA.

Chemistry of Carbon Compounds. Vol. II. Part A. Alicyclic Compounds. Edited by E. H. Rodd. (Elsevier Publishing Co., Amsterdam), 1952. Pp. xx + 488. Price 75 sh.

The object of this 5-volume treatise is 'to fill the need for an up-to-date systematic book intermediate in size between the great Encyclopædias such as Elsevier and Beilstein and the shorter and mainly instructional works such as Karrer and Fieser. It may be regarded as a successor to Richter's "Organic Chemistry". Nine of the eleven chapters in the present volume, very ably written by a single author, Dr. R. A. Raphael, comprise a general introduction to alicyclic compounds; cyclopropane, cyclobutane, cyclopentane, cyclohexane, cycloheptane, cyclo-octane and macrocyclic groups; polynuclear alicyclic compounds with separate ring systems, spiro compounds and condensed cyclic systems; and bridged ring systems. Brief accounts (by Dr. L. Crombie) of pyrethrins, cinerins and jasmone, and of hydnocarpic, chaulmoogric, goric and related acids are included in Chapter IV (cyclopentane group). Chaulmoogric oil is mentioned as an ancient remedy for tuberculosis and leprosy without an indication that its use in leprosy is well established, while it has no therapeutic value in tuberculosis. A reference is made to the work of R. Adams on the preparation of analogues of chaulmoogric and hydnocarpic acids as possible leprocides, but not to his observations regarding relationships between *in vitro* leprocidal activity, chemical constitution and surface activity. Among the properties of dihydroresorcinol and

dimedone an omission is their ability to couple with diazonium salts; the use of such azo dyes for cellulose acetate has been suggested.

Dr. R. F. Hunter has a very lucid and readable chapter on the carotenoid group.

Chapter XI by Dr. R. G. R. Bacon deals with open-chain and cyclic polymers derived from olefinic compounds: rubber and rubber-like compounds, natural and synthetic, and their derivatives. Evidence in favour of the presence of 1:2'-linkages in polyindenes has not been mentioned.

A few typographical errors (e.g., "an" for "as" in p. 426, line 41; "emulsion" in line 38 and "a:1 mixtures" in line 39, p. 428) have been noticed.

In contrast with Vol. I, and inevitably so because of the difference in the contents of the two volumes, parts of Vol. II are not easy to read and it will be valued primarily as a comprehensive and dependable book of reference.

K. V.

Plant Life in the Scottish Highlands. (*Ecology and Adaptation to Their Insect Visitors*.) By Alexander Edward Holden, with photographs by Robert M. Adam. (Oliver & Boyd), 1952. Pp. xv + 319. Price 30 sh. net.

This book, though of value to the general botanist, is intended for hill-walkers and visitors to the Scottish Highlands who do not want a complicated text-book on the hill plants, but would like to know the names of the plants they come across during their wanderings on the hills. It is intended to help them to identify the plants and also to give them a short account of the life-history of the plants, their adaptation to surroundings and their insect visitors. The book is illustrated by numerous excellent photographs by Mr. Robert M. Adam, which will enable the reader to get a clear idea of the plants and will easily enable them to identify them.

The book gives the reader an excellent idea of the great untamed wilderness of mountains, moorland and bog known as the Scottish Highlands. The author has portrayed the beauties of this lovely country, with special reference to its flowering plants and the conditions which influence their growth. The flora is akin to that of Scandinavia, but many species found there are peculiar to the region, and many are highly interesting from a scientific, as well as from an aesthetic point of view.

The author describes the flora in easy language so that the ordinary reader will have little difficulty in recognizing the commoner

species. He gives an account of each plant in relation to its environment and also the conditions of life it has to face, with special reference to its adaptations to combat these conditions. He describes in a graphic manner the beautiful places these plants inhabit, with descriptions of some of the loveliest spots in the Highlands. He also describes how their flowers are amazingly constructed with regard to their insect visitors and fertilization.

The book is most delightfully written and makes fascinating reading.

The book will also serve as an excellent introduction to plant ecology and will be found very useful both to the ordinary reader and the general botanist alike. The book ought to find a place not only in the library of every plant lover but also in the libraries of the botany departments of all colleges.

M. O. P. IVENGAR.

Immunochemistry. (*Biochemical Society Symposia No. 10.*) Edited by R. T. Williams. (Cambridge University Press), 1953. Pp. 94. Price 12 sh. 6 d. nett.

The book is a compilation of seven important papers communicated to the Biochemical Society's Symposium on Immunochemistry held at the London School of Tropical Medicine on 15th November 1952, and carries a short introduction by J. R. Marrack. A fairly full survey with valuable references is presented on each subject by specialists actively engaged in research in the respective fields in a clear and excellent form and is therefore of great value to both students and investigators who are concerned with the different problems in immunochemistry.

The first three communications deal mainly with investigations on the nature and mechanism of antigen-anti-body reactions studied in relation to protein structure by J. R. Marrack in the first paper, to systems involving enzymes as antigens by B. Cinader in the second paper and to systems involving bacterial toxins and anti-toxins by W. E. Van Heyningen in the third paper.

The next paper by G. E. Francis on "The Use of Isotopes in Immunology" brings out fully the important use of isotopic tracer techniques in studies on antigen-anti-body reactions and those on the formation, structure and *in vivo* action of anti-bodies.

The paper by P. G. H. Gell embodies studies on the role of antigens and anti-bodies on the two important and well accepted states of hypersensitivity, namely, the asthma-œdema-

anaphylaxis type and the tuberculin-dermatitis type.

In the sixth paper by M. Stacey 'On the Role of Carbohydrates in Immunochemistry', the outstanding work of Heidelberger and his associates on pneumococcal capsular type specific polysaccharides and the studies on the complex polysaccharides of mycobacterium tuberculosis by the author and his colleagues have been mainly reviewed and discussed.

The final paper by R. G. S. Johns presents a review and discussion of the studies on the relation of complement to the nitrogen bound by antigen antibody precipitates.

As a whole, the monograph is exceedingly well executed.

P. SESHAGIRI RAO.

Books Received

The Indus Civilization. By Mortimer Wheeler. (Cambridge University Press), 1953. Pp. xi + 98. Price 18 sh. net.

Thermionic Valves, Their Theory and Design. By A. H. W. Beck. (Cambridge University Press), 1953. Pp. xvi + 570. Price 60 sh. net.

Corrugated Concrete Shell Roofs.—Bullet. Cent. Build. Res. Inst., Vol. 1, No. 3. (C.S.I.R.), 1953. Pp. 38. Price Rs. 1-8-0.

Advances in Virus Research. Edited by Kenneth M. Smith and Max A. Lauffer. (Academic Press, Inc.), 1953. Pp. vii + 362. Price \$ 8.00.

Mechanical Vibration. By G. W. Van Santen. (Philips' Technical Library), 1953. Pp. xvi + 296. Price not known.

Statistical Methods in Electrical Engineering. By D. A. Bell. (Chapman & Hall), 1953. Pp. viii + 175. Price 25 sh. net.

The Chemistry of Heterocyclic Compounds—Imidazole and Its Derivatives. By Klaus Hofmann. (Interscience Publishers), 1953. Pp. xviii + 447. Price \$ 13.50.

Relays for Electronic and Industrial Control. By R. C. Walker. (Chapman & Hall), 1953. Pp. xi + 303. Price 42 sh. net.

International Review of Cytology, Vol. II. Edited by G. H. Bourne, J. F. Danielli. (Academic Press, Inc.), 1953. Pp. vii + 545. Price \$ 11.00.

Data and Circuits of Television Receiver Valves. By J. Jager. (Philips' Technical Library), 1953. Pp. xi + 216. Price Rs. 10.

Fluorescence of Solutions. By E. J. Bowen and Frank Wokes. (Longmans, Green & Co.), 1953. Pp. vii + 91. Price Rs. 25.

An Introduction to Electronics for Physiological Workers. By I. C. Whitefield. (Macmillan & Co.), 1953. Pp. ix + 236. Price 18 sh.

Scientific Papers Presented to Max Born. (Oliver & Boyd), 1953. Pp. vi + 94. Price 12 sh. 6 d. net.

An Introduction to the Theory of Seismology. By K. E. Bullen. (Cambridge University Press, Inc.), 1953. Pp. xv + 296. Price 35 sh.

Selected Topics from Organic Chemistry, Third Edition. By D. D. Karve and G. D. Advani. (Dastane Brothers' Home Service, Ltd., Raviwarpet, Poona 2). Pp. vi + 507. Price Rs. 12.

A Class Book of Physics, Fourth Edition. By Gregory and Hadley (Macmillan & Co.), 1953. Pp. xiii + 656. Price 12 sh. 6 d.

Tables of Barometric Pressures at Varying Temperatures. By J. D. W. Ball. (Constable & Co.), 1953. Pp. 23. Price 5 sh.

Tables of Natural Logarithms for Arguments Between Zero and Five to Sixteen Decimal Places. (NBS Applied Mathematics Series 31, U. S. Dept. of Commerce), 1953. Pp. x + 501. Price \$ 3.25.

Simultaneous Linear Equations and the Determination of Eigen Values. Edited by L. J. Paige and Olga Tanssky. (NBS Applied Mathematics Series 29, U.S. Dept of Commerce), 1953. Pp. iv + 126. Price \$ 1.50.

An Introduction to the Theory of Seismology. Second Edition. By K. E. Bullen. (Cambridge University Press), 1953. Pp. xv + 296. Price 35 sh. net.

Animal Nutrition Research in India. By K. C. Sen. (Macmillan & Co., Calcutta-12), 1953. Pp. xii + 370. Price Rs. 15.

Medicine in Oxford, A Historical Romance. By Maurice Davidson. (Macmillan & Co.), 1953. Pp. 70. Price 10 sh. 6 d. net.

Experimental Inorganic Chemistry. By R. E. Dodd and P. L. Robinson. (Elsevier Publishing Co.), 1954. Pp. xii + 424. Price 42 sh.

SCIENCE NOTES AND NEWS

Lady Tata Scientific Research Scholarships, 1954-55

The Trustees of the Lady Tata Memorial Trust are offering six scholarships of Rs. 250 each per month for the year 1954-55 commencing from 1st July 1954. Applicants must be of Indian nationality and Graduates in Medicine or Science of a recognized University. The scholarships are tenable in India only and the holders must undertake to work whole-time under the direction of a scientist of standing in a recognized research institute or laboratory on a subject of scientific investigation that must have a bearing either directly or indirectly on the alleviation of human suffering from disease. Applications must conform to the instructions drawn up by the Trust. Candidates can obtain these instructions and other information they desire from the Secretary, The Lady Tata Memorial Trust, Bombay House, Bruce Street, Fort, Bombay-1.

Symposium on Wind Power and Solar Energy

India has accepted the invitation of the Director-General of UNESCO to act as the host country for the symposium to be held in October 1954, under the auspices and as part of the activities of the UNESCO Advisory Committee on Arid Zone Research. The National Institute of Sciences will organize the symposium on behalf of the Government of India, jointly with UNESCO.

Synthesis of Sucrose

The chemical synthesis of sucrose was among the major advances reported at the American Chemical Society's 124th National Meeting, held in Chicago during September 6-11, 1953. Raymond U. Lemieux, and George Huber of the Prairie Regional Laboratory of the Canadian National Research Council at Saskatoon tackled the project last April despite overwhelming evidence that it could not be done. By June they succeeded in making sucrose out of derivatives of glucose and fructose, which had been made synthetically by previous investigators. Lemieux and Huber also synthesized maltose and a less common sugar, trehalose, in the course of their experiments.

Since natural sucrose is both abundant and cheap, the synthetic product is unlikely to find commercial application, but the Lemieux-

Huber achievement represents a significant contribution to carbohydrate chemistry which promises to make the synthesis of many complicated substances a matter of easy routine.

Ductile Iron

The development of a variety of cast iron which can twist, bend and bounce on impact instead of breaking has been announced in a recent issue of the *Journal of the Franklin Institute* (1953, 255, 342). Basically, ductile iron is made by adding a small amount of magnesium and nickel to iron. In engineering properties it bridges the gap between cast iron and steel. It is wear and heat-resistant and has numerous applications in almost every branch of industry.

Exemption of Customs Duty on Research Material

The Government of India have decided to consider, on an *ad hoc* basis, requests for the grant of exemption from customs duty leviable on research materials, such as sera, vaccines, drugs, etc., supplied free of cost to approved Government research institutions for research purposes. Applications for the grant of exemption from duty may be made to the Ministry of Finance (Revenue Division) through the Collector of Customs or the Collector of Central Excise concerned.

X-Ray Therapy

A 15-million volt linear accelerator, stated to be the most powerful apparatus of its kind in existence for medical purposes, is to be installed at St. Bartholomew's Hospital, London, for X-ray therapy.

The accelerator produces penetrating rays by the bombardment of platinum foil with electrons of a potential of 15 million volts: by comparison, the cobalt bomb, another recent device for therapy, produces X-rays of 1,300,000 volts. The great penetration of the X-rays makes it a powerful means of treating tumours situated deep in the body, at the same time reducing the damage to skin and other superficial tissue.

In addition to the high energy, the output of X-rays from the accelerator will be about 50 times greater than that from ordinary X-ray

machines or the cobalt bomb. It will be used for the treatment of cancer, the development of new methods of treatment and fundamental research on the effects of high energy on the body.

Study of Poliomyelitis

A worldwide programme of research on poliomyelitis has been recommended to the World Health Organization by an Expert Committee which met recently in Rome. It is proposed that designated research laboratories in all continents should function as WHO Regional Laboratories and that they undertake various studies, particularly in identifying and examining various strains of the poliomyelitis virus. While the incidence of a number of epidemic diseases has been sharply reduced, the Expert Committee observed that poliomyelitis is likely to present an increasingly serious problem in almost all countries of the world. Proposals of the Committee are to be considered by the WHO Executive Board shortly.

Artificial Hibernation in Heart Surgery

One of the difficulties about surgical operations upon the heart and in certain other circumstances is that it may be necessary to stop the circulation of the blood for a period of time. Certain vital centres, for example in the brain, may be seriously affected by this, but it has been found that if the demands of the body cells for oxygen could be diminished, then a relatively longer period of reducing or cutting off the blood supply would be possible with safety.

Out of this idea has come the present method of reducing body temperature, a sort of 'artificial hibernation' so as to diminish the chemical activity of body cells. Three reports in a recent issue of the *British Medical Journal* are concerned with this new problem. Various ways of lowering body temperature have been devised and, in fact, the method is already in use in certain centres for heart surgery in Great Britain and abroad.

National Institute of Sciences of India

Officers for 1954: *President*: Dr. K. S. Krishnan (Delhi); *Vice-Presidents*: Prof. S. K. Banerji (Calcutta); and Dr. B. Mukerji (Lucknow); *Treasurer*: Prof. D. S. Kothari (Delhi); *Foreign Secretary*: Prof. P. C. Mahalanobis (Calcutta); *Secretaries*: Prof. R. C. Majumdar (Delhi); and Dr. B. P. Pal (Delhi); *Editor of Publications*: Prof. J. M. Sen (Calcutta).

Ordinary Fellows: Dr. B. C. Basu (Izatnagar), Dr. S. K. Bhattacharya (Kharagpur), Dr. K. Chandrasekharan (Bombay), Prof. K. R. Dixit (Bombay), Dr. S. Ghosh (Allahabad), Dr. A. G. Jhingran (Calcutta), Prof. S. Kilpady (Nagpur), Dr. Z. R. Kothavala (Bangalore), Dr. L. S. S. Kumar (Poona), Mr. N. V. Modak (Bombay), Dr. C. Radhakrishna Rao (Calcutta), Mr. A. K. Roy (New Delhi), Dr. R. N. Sen (Calcutta), Principal M. R. Sen Gupta (Banaras), Dr. S. M. Sircar (Calcutta), *Honorary Fellows*: Prof. Sydney Chapman (Oxford), Prof. V. A. Engelhardt (Moscow), Prof. W. Heisenberg (Gottingen, West Germany), Prof. Paul Karrer (Switzerland).

Indian Botanical Society

The following authorities of the Indian Botanical Society have been constituted for the year 1954 as the result of election announced at the 33rd Annual General Meeting of the Society held at Hyderabad.

President: Dr. R. K. Saksena, Allahabad; *Vice-Presidents*: Dr. K. A. Chowdhury, Dehra Dun; and Dr. Y. Bharadwaja, Banaras; *Hon. Secretary*: Dr. R. Misra, Sagar; *Treasurer and Business Manager*: Dr. T. S. Sadasivan, Madras; *Editor-in-Chief*: Dr. A. C. Joshi, Chandigarh.

Award of Research Degree

On the basis of the report of a Board of Examiners, the Banaras Hindu University has awarded the Ph.D. Degree in Biochemistry to Sri. Brij Mohan Lal for his thesis entitled "Studies in Supplementary Food".

The Bombay University has awarded the Ph.D. Degree in Chemistry to Shri Dhirajlal N. Shah for his thesis entitled "Studies in Fries Migration".



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